UNCLASSIFIED

AD NUMBER AD804523 **NEW LIMITATION CHANGE** TO Approved for public release, distribution unlimited **FROM** Distribution: Further dissemination only as directed by Federal Aviation Agency, Director of Supersonic Transport Development, Washington, DC 20553, Sep 1966, or higher DoD authority. **AUTHORITY** FAA ltr, 10 Oct 1972



Pratt & Whitney Aircraft FLORIDA RESEARCH AND DEVELOPMENT CENTER

U

Best Available Copy

NOTICES

When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely related Government procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever; and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data, is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

All distribution of this document is controlled. This document may be further distributed by any holder only with specific prior approval of:

Director of Supersonic Transport Development. Federal Aviation Agency Washington, D. C. 20553

The distribution of this document is limited because it contains technology identifiable with items excluded from export by the Department of State (U. S. Export Control Act of 1949 as amended).



PWA FF 66-100 SEPTEMBER 1966

571p.

ENGINE PROPOSAL

FOR PHASE III OF THE

SUPERSONIC TRANSPORT DEVELOPMENT PROGRAM,

VOLUME Y. MANAGEMENT AND MANUFACTURING

REPORT H-DETAIL WORK PLAN,

) FA-SS-66-8



(14) PWA-FP-66-100-VOI-5

(COMPETITIVE DATA)

PREPARED FOR

FEDERAL AVIATION AGENCY OFFICE OF SUPERSONIC TRANSPORT DEVELOPMENT WASHINGTON, D.C.

Pratt & Whitney Aircraft DIVISION OF UNITED AIRCRAFT CORPORATION FLORIDA RESEARCH AND DEVELOPMENT CENTER

(401355) AE

11

Pratt & Whitney Aircraft PWA FR 66-100 Volume V Report H

THE RESIDENCE OF THE PARTY OF T

CONTENTS

		PAGE
	INTRODUCTION	VH - 1
SECTION I	ENGINE AND COMPONENT DEVELOPMENT	VH - 5
1.01	Engine Design	VH - 5
1.02	Fabrication and Assembly	
1.03	Tooling	
1.04	Engine Instrumentation	VH - 19
1.05	Test Equipment	VH - 23
1.06	Engine Test — Ground	VH - 27
1.07	Engine Performance	VH - 37
1.08	Inlet System Compatibility	VH - 41
1.09	Noiss	
1.10	Growth Potential	VH - 49
1.11	Fan and Compressor	VH - 53
1.12	Primary Combustor	VH - 57
1.13	Turbine	_VH - 61
1.14	Augmentor	VH - 65
1.15	Exhaust System	
1.16	Controls and Accessories	VH - 73
1.17	Lubricants, Lubrication System, Pearings, Seals, and Gears	VH - 79
1.18	Fuels	
1.19	Manufacturing Techniques and Materials	VH - 89
1.20	Weight Control and Status	VH - 93
SECTION !	I. MANAGEMENT CONTROLS AND PRODUCT ASSURANCE	VH - 97
2.01	Coordination	VH - 97
2.02	Maintainability and Human Engineering	VH - 99
2.03	•	VH - 103
2.04	Quality Assurance	VH - 107
2.05	Value Engineering	VH - 111
2.06	Configuration Management	VH - 115
2.07	Safety	VH - 119
2.08	Test Planning and Integration	VH - 123
2.09	Data Management	VH - 127
2.10	Program Management and Controls	VH - 131
2.11	Facilities Plan	VH - 133
2.12	Cost Analyses	VH - 137
0.10	No.	V/U 190

Pratt & Whitney Aircraft
PWA FP 66-100
Volume V
Report H

CONTENTS (Continued)

		PAGE
SECTION	III. DELIVERY AND PRODUCT SUPPORT	VH - 141
3.01	Ground, Taxi, and Flight Test Engines	VH - 141
3.02	Tooling	VH - 145
3.03	Engine Performance	VH - 149
3.04	Engine Mockup	VH - 153
3.05	Spares	VH - 157
3.06	Overhaul	VH - 159
3.07	Engine Test and Evaluation — Flight	VH - 163
3.08	Data and Handbooks	VH - 167
3.09	Training and Training Equipment	VH - 169
3.10	Ground Support Equipment	VH - 171
SECTION	IV. CROSS-REFERENCE INDEX	VH - 173

PWA FP 66-100 Volume V

REPORT H DETAIL WORK PLAN

INTRODUCTION

This report presents a description of the total effort to be accomplished in the design, development, prototype delivery and operational support of the Pratt & Whitney Aircraft JTF17 engine during Phase III of the Supersonic Transport Engine Program. This total effort includes:

Section I Engine and Component Development; Section II Management Controls and Product Assurance; and Section III Delivery and Product Support. The material in this plan is presented in relation to the Level III areas of the work breakdown structure with each Level III area providing an activity description, milestone chart and network chart, including an event dictionary for each network chart. For those areas where a network is inappropriate, only a schedule is presented. The Level III areas of the work breakdown structure are described in the Work Statement in Volume VI.

of this proposal.

This engine development program is patterned upon our previous development programs for both commercial and military engines. Specifically, the JTF17 engine development program follows the development steps of the high Mach number J58 engine, and reflects the beneficial and invaluable lessons learned from the integration of the engine and airframe through extensive flight and operational experience. The Pratt & Whitney Aircraft JTF17 engine development program also incorporates the added effort required to make the supersonic transport engine suitable for commercial service, and reflects the experience gained in over 39 million hours of turbojet engine operation in commercial service.

It is the goal of the JTF17 engine program to develop the engine to meet the requirements of the engine model specification and to obtain the engine maturity required for commercial use. Demonstration of this maturity will be the Flight Test Status Test required in Phase III, and the Certification Test required in Phase IV.

During Phase III a total of 20 engines will be delivered to the airframe manufacturer. Four engines will be delivered prior to FTS for ground test use. If required, four additional engines will be delivered for aircraft taxi tests. It is planned to modify the four taxi test engines after completion of the test to the FTS engine configuration for use in the prototype flight program. Sustaining engineering offort will be provided in Phase III to support the JTF17 prototype engine delivery and operation through the 100-hour aircraft flight program.

Pratt & Whitney Aircraft PWA FP 66~100 Volume V

CONTENTS

		PAGE
	INTRODUCTION	VH-1
SECTION I	. ENGINE AND COMPONENT DEVELOPMENT	VH-5
1.01	Engine Design	VH-5
1.02	Fabrication and Assembly	VH-9
1.03	Tooling	VH-15
1.04	Engine Instrumentation	VH-19
1.05	Test Equipment	VH-23
1.06	Engine Test - Ground	VH-27
1.07	Engine Performance	VH-37
1.08	Inlet System Compatibility	VH-41
1.09	Noise	VH- 45
1.10	Growth Potential	VH-49
1.11	Fan and Compressor	VH-53
1.12	Primary Combustor	VH-57
1.13	Turbine	VH-61
1.14	Augmentor	VH-65
1.15	Exhaust System	VH-69
1.16	Controls and Accessories	VH-73
1.17	Lubricants, Lubrication System, Bearings, Seals, and Gears	VH-79
1.18	Fuels	VH-85
1.19	Manufacturing Techniques and Materials	VH-8 9
1.20	Weight Control and Status	VH-93
SECTION I	I. MANAGEMENT CONTROLS AND PRODUCT ASSURANCE	VH-97
2.01	Coordination	VH-97
2.02	Maintainability and Human Engineering	VH-99
2.03	Reliability	VH-103
2.04	Quality Assurance	VH-107
2.05	Value Engineering	VH-111
2.06	Configuration Management	VH-115
2.07	Safety	VH-119
2.08	Test Planning and Integration	VH-123
2 00	Data Management	VH-127

PWA FP 66-100 Volume V

CONTENTS (Continued)

		PAGE
2.10	Program Management and Controls	VH-131
2.11	Facilities Plan	VH-133
2,12	Cost Analyses	VH-137
2.13	Proposals	V H-139
SECTION I	II. DFLIVERY AND PRODUCT SUPPORT	VH-141
3.01	Ground, Taxi, and Flight Test Engine	V H-141
3.02	Tooling	v n-145
3.03	Engine Performance	V H-149
3.04	Engine Mockup	VH-153
3.05	Spares	V H-157
3.06	Overhaul	VH-159
3.07	Engine Test and Evaluation - Flight	VH-163
3.08	Data and Handbooks	VH-167
3.09	Training and Training Equipment	VH-169
3.10	Ground Support Equipment	VH-171
SECTION I	V. CROSS-REFERENCE INDEX	V H-173

PWA FP 66-100 Volume V

SECTION I ENGINE AND COMPONENT DEVELOPMENT

1.01 ENGINE DESIGN

Design of the JTF17 engine, excluding the prototype control system, will have been completed by the end of Phase II-C. Early in Phase III the design of the prototype control system will be completed, and engine manufacturing drawings and an assembly parts list will be prepared and released. Subsequent to the engine release, major effort will be devoted to continuous refinement of component designs based on changing airframe requirements and on test experience gained from component rig tests; from engine test stand operation; from our continuing high Mach number flight experience; and from our commercial engine operation. Refinements may consist of minor modifications or major redesigns, as requirements dictate. Alternative designs of engine components will be completed for evaluation; these designs will be based on results of the test program and continued analysis.

Major effort will continue to be devoted to considerations such as safety and reliability, performance, weight, maintainability, and value engineering. To secure the earliest possible testing experience, design information will be made available prior to completion of manufacturing drawings to allow advance procurement of raw materials and tooling for time-critical parts manufacture.

The design of component test rigs will be completed and manufacturing drawings released. The use of such rigs will supply data for the component and engine test program.

Close design coordination will be maintained with the airframe contractor. This coordination will be directed toward ensuring that installation requirements for both engine and airframe are realistic and are being met.

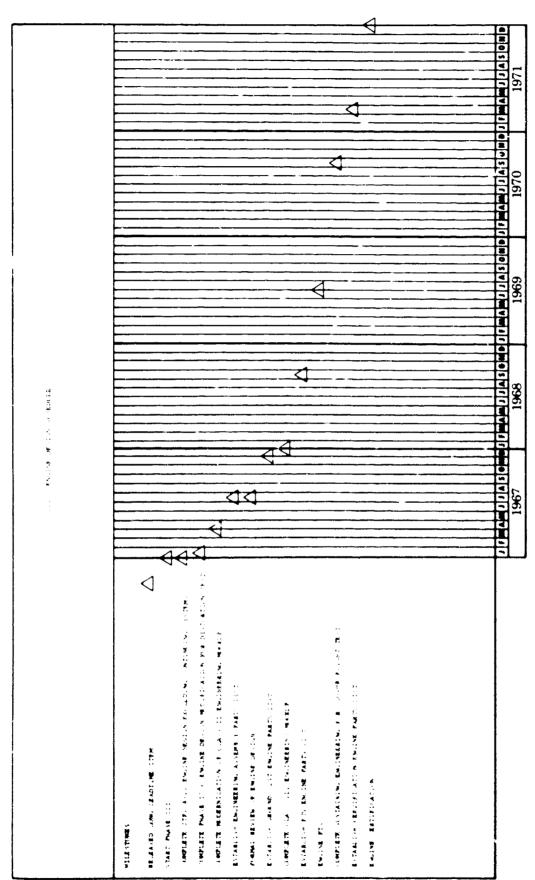
Full-scale design engineering mockups will be used and maintained to assist in the design and installation activities.

The major milestones, network chart and event dictionary for engine design are shown in figures 1 and 2, respectively.

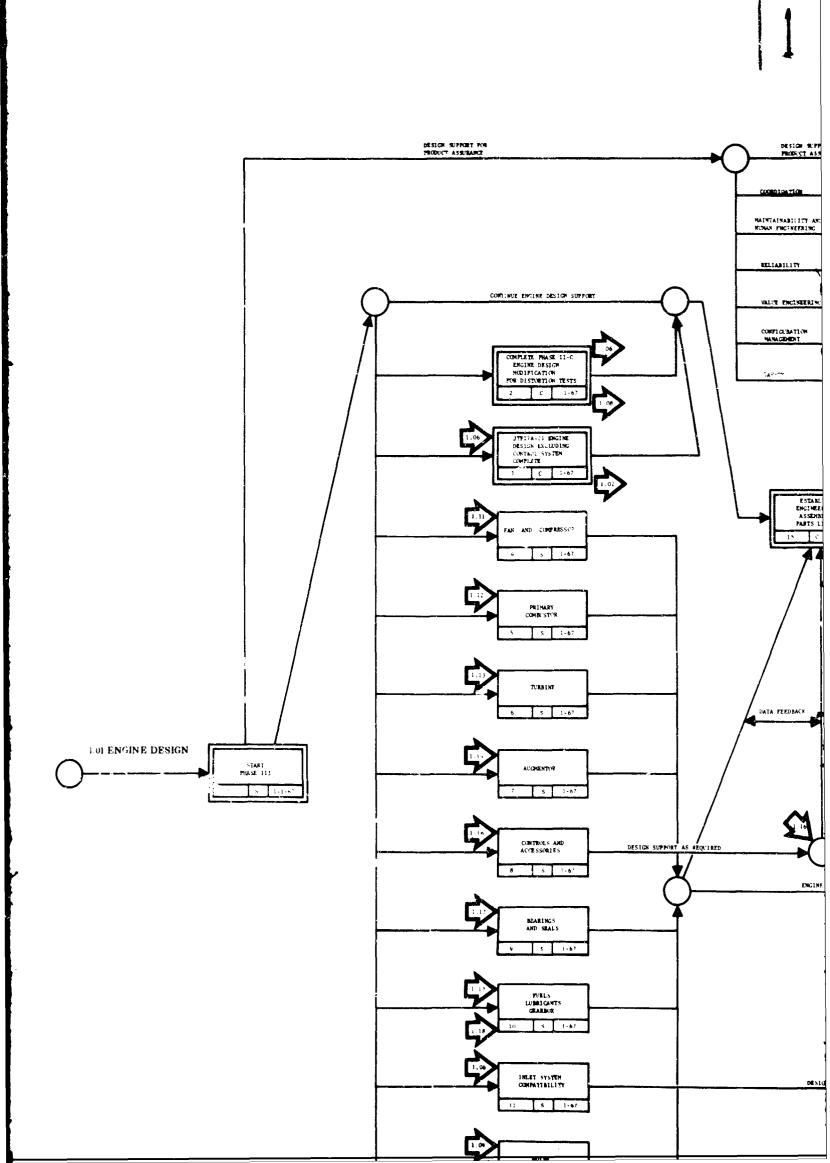
A detailed description of Engine Design is presented in Volume III, Report B, and test integration of the design effort is presented in Test, Volume IV, Report E.

Pratt & Whitney Aircraft PWA FP 66-100 Volume V

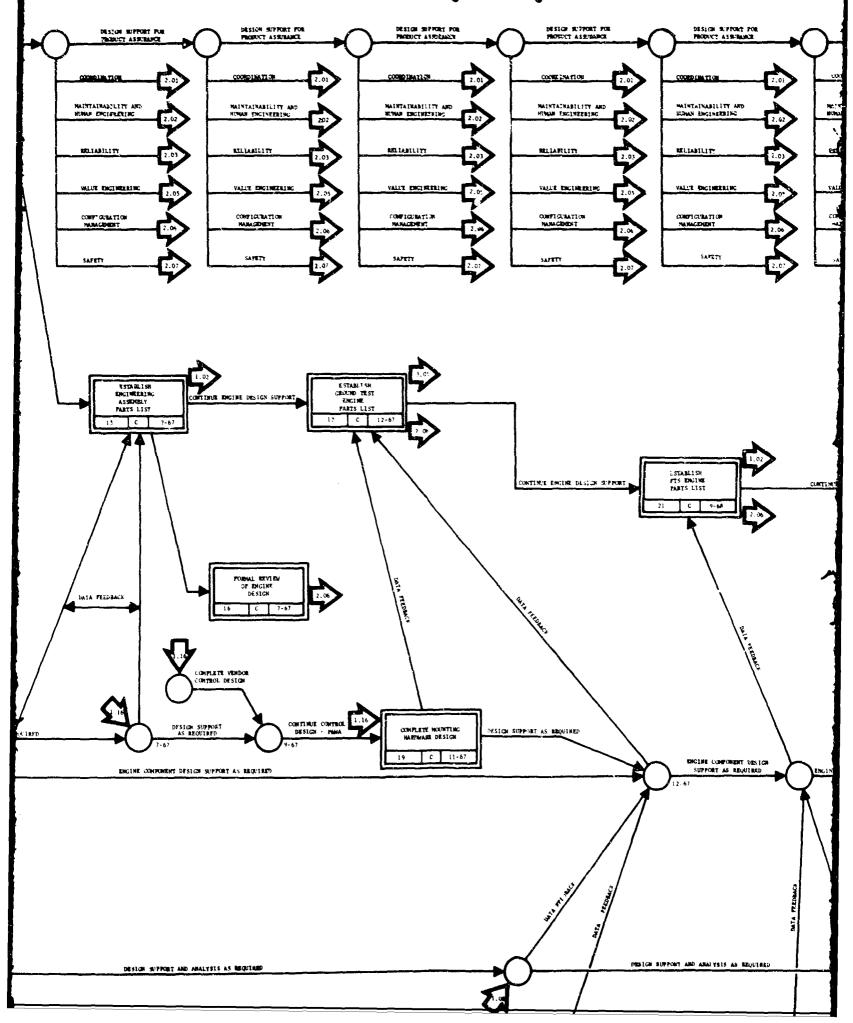
FD 17859 VH

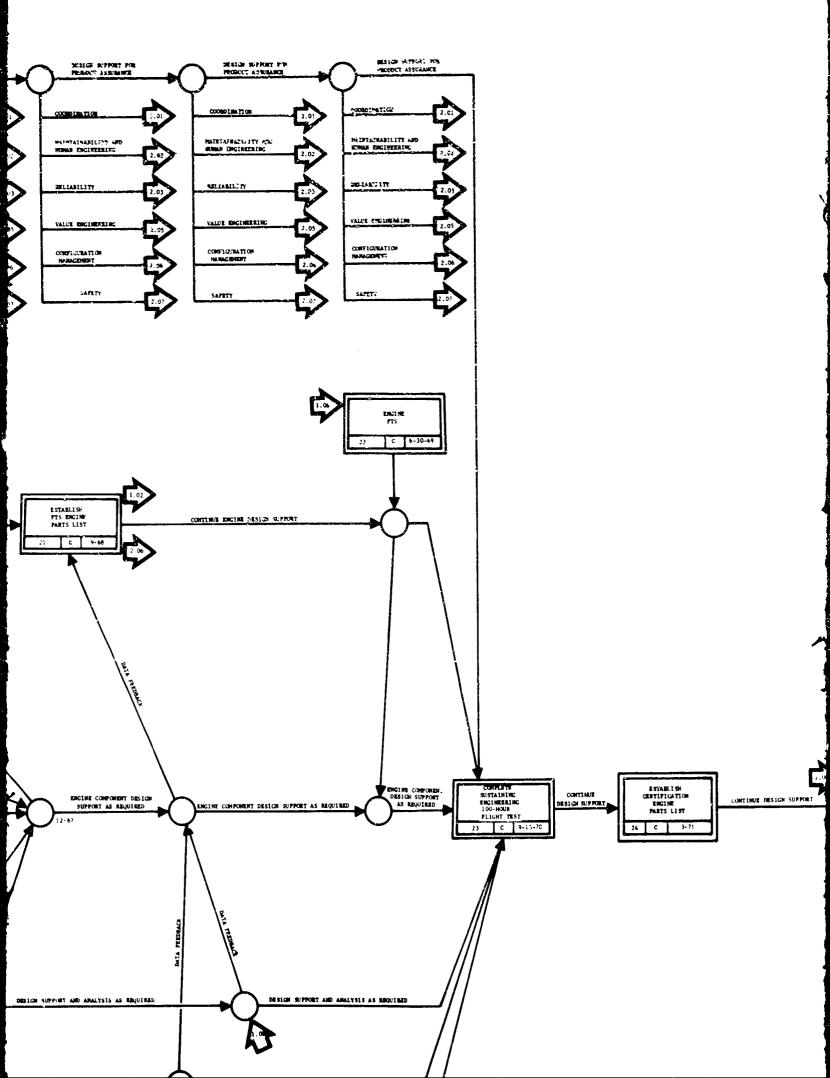


1.01 Engine Lasien Figure 1.

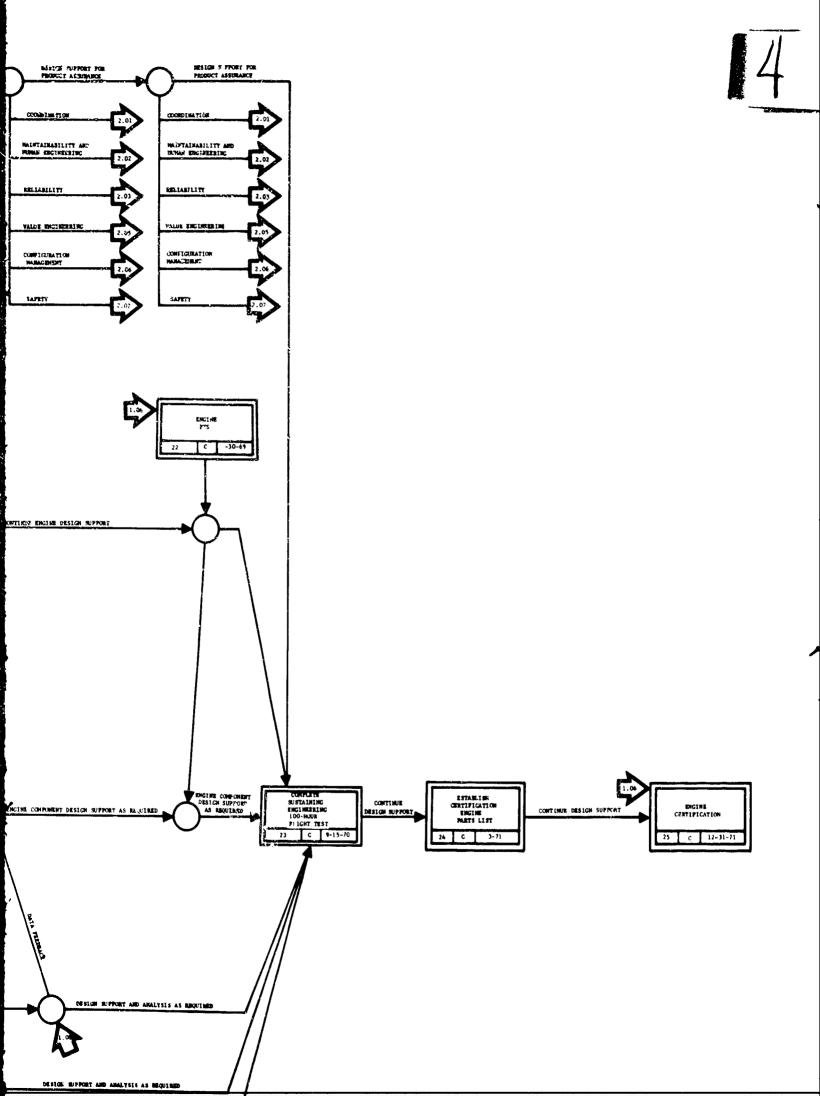


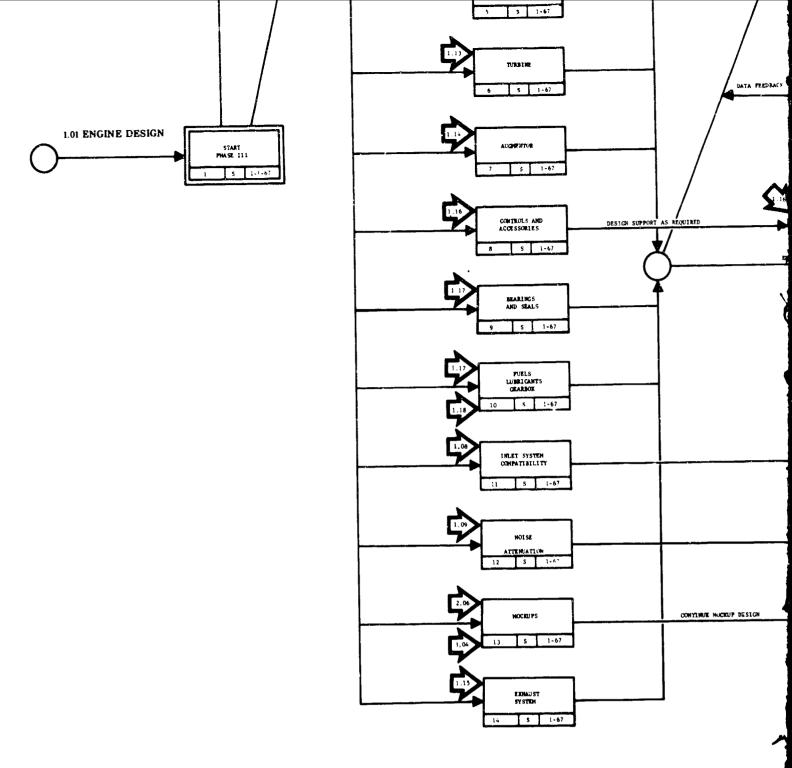
1.01 Engine Design





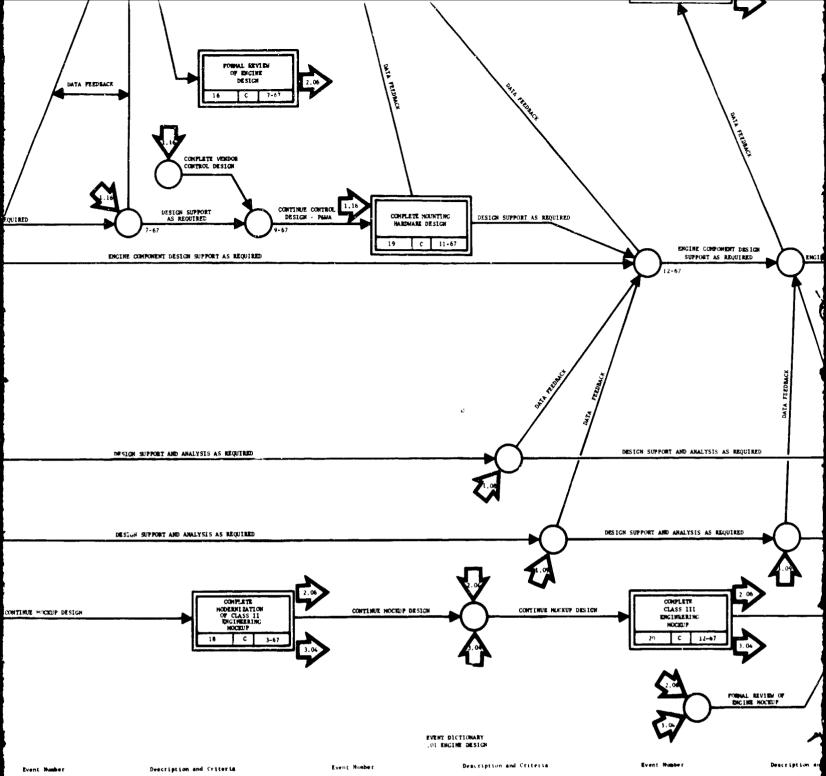
PWA FP 66-100 Volume V



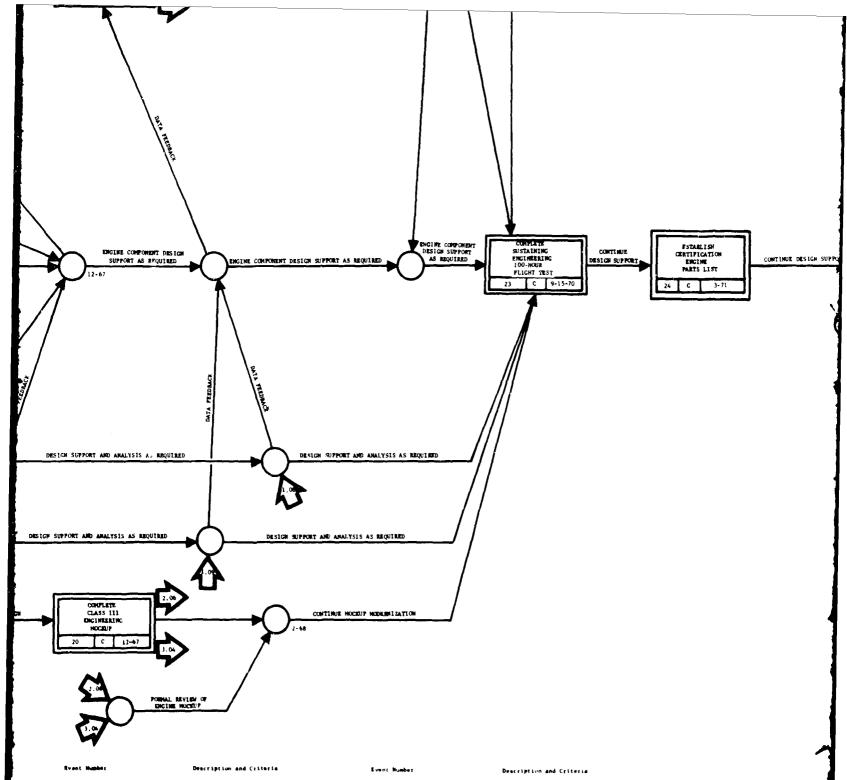


Event	Number	Description and Criteria	Event	(Cupit + T
	ì	START PHASE III		6
	•	Start of Phase Ili.		
		Received Phase III go-attend from FAA.		
	1	PHASE II-C ENGINE DESIGN MODIFICATIONS FOR		
	•	DISTORTION TESTS		7
		Complete Phase II-C engine design modifications		
		to investigate the effects of inlet distortion		
		Release manutacturing drawings.		
		PROJUTYPE ENGINE DESIGN LESS CONTROLS SYSTEM		
	•	Complete prototype engine design excluding		
		controls system. Release of prototype engine		
		manufacturing drawings.		
	4	FAN AND COMPRESSOR		4
	•	Continuing design effort to improve component		
		perturmance, d rability and productbility.		
		Phase III go-anead.		
	,	PRIMARY COMMISSION		10
	,	Continuing design effort to improve component		
		performance, durability and producibility.		
		Phone III go-ahead.		

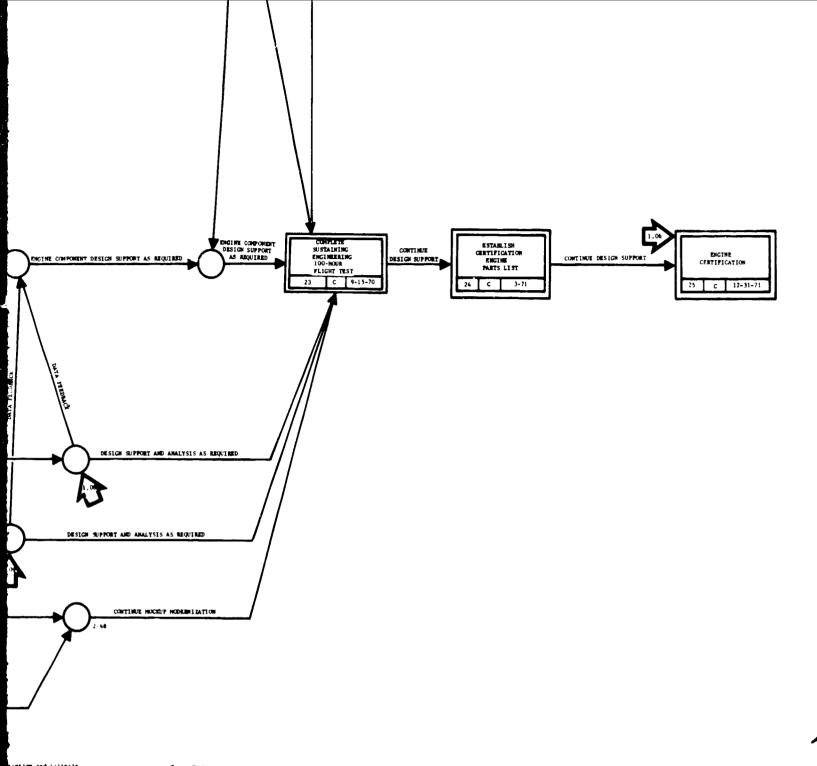
Figure 2. 1.01 Engine Design



Event Number	Description and Criteria	Event Number	Description and Criteria	EASUL MARGEL	pacetytism a
6	TUBBING Continuing design effort to improve component performance, durability and producibility Phase III go-shead.	11	INLET SYSTEM COMPATIBILITY Continoing design effort to improve component porformance Phase III go-anced.	16	FORMAL REVIEW OF ENGINE Complete design seview Complete design seview
	mase in go-ansed.			ι	GROUND TEST ENGINE PART
,	AUGMENTOR Continuing design eifort to improve component	12	NOISE ATTENUATION Conc. a being offer to prove notes Attenuation		Establish ist.ond Test e Release Patts list
	performance, durability and producibility. Phase III go-shoad.		Phase 111 go-shead.	i B	MUDGRHIZATION OF CLASS Complete modernization
• *	CONTROLS AND ACCESSORIES Continuing design wifort to improve component	11	MCCRUPS Continuing design effort to improve engine to		Engineering muckup is to
	performance, durability and producibility Phase ill go-shead		attframm compatibility. Phase III go-shead.	14	COMPLETE MOUNTING MARDM Design of military hard accessories is complete
4	BEARINGS AND SEALS	1+	EXMANST SYSTEM Continuing design effort to improve component		Release manufacturing d
	Continuing design effort to improve component performance, durability and producibility. These III go-sheed.		performance, durability and producibility. Phase 111 go-shoad	30	COMPLETE CLASS III ENG! Complete fabrication go regimenting mothup. F
iu	FUELS, IUMBICANTS AND CEARBOX Continuing design effort to improve component performance, durability and productbility. Phase III go-shead.	15	SMCIMERIM: ASSEMBLY PARTS LIST Satablish Engineering Assembly Parts List Selease of Parts List.		1003.00



Event Humber	Description and Criteria	Event Humber	Description and Criteria
16	PURMAL REVIEW OF ENGINE DESIGN Conduct formal review of engine design.	23	FTS EMGIME PARTS LIST Katablish FTS ongine Parts List
	Complete design review.		Release FTE engine Parte List
12	LEGGED TEST ENGISE PARTS 11ST	n	ENCINE FTs
	Establish Ground Test engine Parte List. Release Parts List.		Reference engine network 1,06 for description and criteria
1.0	MUDERNIZATION OF CLASS II ENGINEERING MUCKUP Complete modernization of engineering module	£1	COMPLETE SUSTAINUM, ENGINEERING POR 100 MODES FLIGHT TEST
	guitnessing docknoh to teach for teacted		End of Phase III
į w	COMPLETE HORITETED MARRIAGE DESTON		Completion of 100-hour Flight Teer Frogress
	Design of monting hardware for controls and accessories is completed	2 A	CERTIFICATION ENGINE PARTS LIST Certification engine manufacturing framings are
	Release emeractiviting drawings.		complete. Relegge of cestific tion engine magnifectoring
289	COMPLETE CLASS 111 EMCINERISM MICHELP Complete fabrication and assemble of Class 151		drawings
	engineering michip. Engine michip is ready for	1*	ENGINE CERTIFICATION
	ferieu		Beference engine natures 3 06 for description and criteria



ription and Citieria	Event Number	Description and Criteria
(P EMG138 DESIGN TevkmogE engine design;	21	PTS ENGINE PARTS LIST Retablish PTS ungine Parts Liet
r textor.		Belease FTS engine Parts List
LINE MARTS LIST	2.2	ENGINE PES
hd Tret engine Parta List List		Reference engine network 1.06 for description and criteria
F (LASS I) EMLINERS IN HEXTER	23	COMPLETE SUSTAINING ENGINEERING PUB 100 HOURS
tup is ready for levies		FLIGHT TEST End of Those III
INC MARRIAGE DESTINE		Completion of Lubishour Flight Test Frigress
ting hardware for controls and	i •	CERTIFICATION ENGINE PARTS LIST
ting Discons		Cretification implie manufacturing drawings are complete.
ill kontubertür, uncer e		Betrane of centification begins mamifactiving drawing
ate mignat assemble of Class III		
ap Emp mechanipica septing file	: 1	ENCINE CENTIFICATION
		Botorome organo motomes i the fire description and criteria

FD 17656 VH

1.02 FABRICATION AND ASSEMBLY

FABRICATION

JTF17 Project Engineering authorizes all development parts procurement by issuance of an Engineering Order Supplement, which defines the task to be accomplished and specifies the detail hardware requirements. This nardware is scheduled by quantity and date to predicted needs determined by Project Engineering. The total quantity of test support parts required over a period of one year can be expressed as equivalent sets of parts:

Total Cost of all Test Support Hardware

Average Cost of a Development Engine = Number of Equivalent Sets of Parts

The number of equivalent sets of parts and average number of engines predicted for the JTF17 development effort is as follows:

Year	1967	1968	1969	1970	1971
Average Number of Engines	4	7	11	12	14
Equivalent Engine Sets	11	12	12	12	12.5

Design layouts and detail drawings are approved by Project Engineering and are released from Design to Project Materials Control (PMC) for fabrication by an Experimental Release. Project Materials Control orders and schedules all parts, works directly through Purchasing for subcontracted hardware and works through Scheduling and Expediting for hardware made in-house.

Hardware fabricated "in-house" is submitted to Scheduling and Expediting and a job order is released to the Shop for manufacture. PMC writes Requests for Purchase Orders (RPO) for hardware designated "buy," the order is competitively quoted by Purchasing and placed. In either case, the promised completion or delivery dates must agree with the requested dates specified by Project Engineering. The PMC organization incorporates design changes rapidly. Design changes are discussed prior to release by Project Engineering and the PMC engineer, and "hold" instructions are issued if necessary until formal drawings are available. Hardware obsolescence is thus held to a minimum.

Raw material, when received, is inspected by the Materials Control Laboratory for compliance to specifications and by Quality Assurance for dimensional requirements. Finished purchased parts are inspected for compliance to the drawings and, where applicable, are submitted to the Materials Control Laboratory for testing. By arrangement with Quality Assurance, finished parts may be inspected at a subcontractor's plant.

PWA FP 66-100 Volume V

ASSEMBLY

Assembly of the JTF17 development engines is controlled by an Experimental Engineer assigned to an engine build several months before the required starting date. The Experimental Engineer is responsible for defining the general configuration for the engine to Project Materials Control; PMC then issues a parts list to authorize delivery of the parts from Finished Stores. Engine rebuilds are handled in a similar manner, but a complete definition of parts is not established until inspection after disassembly.

New parts issued by Project Materials Control at the direction of Project Engineering, are delivered to Assembly for an engine or rig. Records of the parts issued are maintained with the engine or rig, and work done is by written instructions of the assigned Experimental Engineer. The rework or reoperation of parts is accomplished from Work Orders written by Assembly personnel. Parts shortage records are also maintained by Assembly personnel. The Shift Superintendent of Assembly conducts daily shortage meetings and scheduled build meetings to control engine and rig build schedules. During the build of the engine or rig, problems encountered are recorded on Deviation Reports which are used as a means of conveying design or deviate part problems to Engineering, Quality Assurance and PMC. Assembly Problem Reports are written to point out corrective action necessary on faulty assembly, damaged parts, or any abnormal conditions.

Engines and rigs returning from Test are disassembled in accordance with the written instructions of the Experimental Engineer.

In addition to engine and rig build service, the Assembly Department provides and installs all special pressure and temperature instrumentation. It also provides a test repair crew for engine and rig repair in the Test Areas and a small machine shop to expedite simple machining needs and special tool repairs.

Shop supplies, assembly tooling and special tooling used to support Engineering requirements are maintained by Assembly. In addition, the Assembly department provides a complete and current blueprint file for use by Assembly and Engineering personnel.

Special instructions to cover processes and materials as directed by Engineering Instructions or bulletins are issued by the Superintendent of Assembly. These are called Experimental Assembly Instructions (EAI). Experimental Assembly Operating Procedures covering methods of operation affecting tooling, parts handling, and agreed-to methods of operation are issued from the Assembly Office.

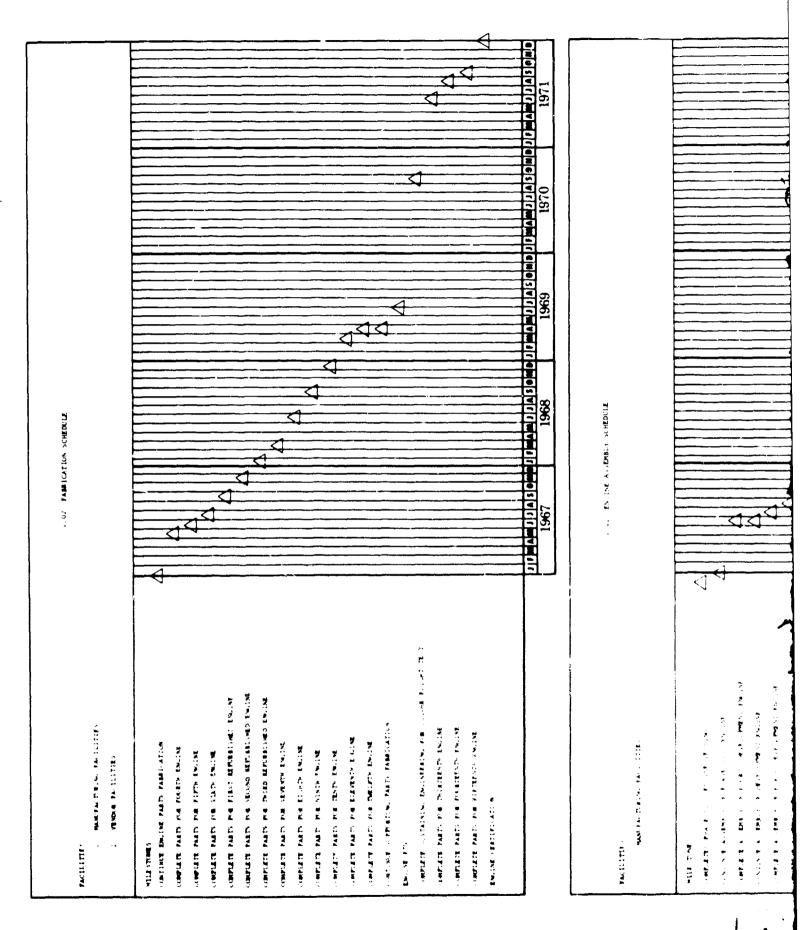
Special equipment such as flow benches, balance machines, spin testing, cleaning equipment, hoists and lifts, work benches and parts tables, etc., are provided and maintained to process engines and rigs through the assembly and disassembly cycles. These items of equipment also provide fulfillment for the manufacturing-in-process parts requirements such as balancing, pressure test, spin zyglo, and proof spinning.

PWA FP 66-100 Vclume V

The major milestones, network chart and event dictionary for fabrication and engine assembly are shown in figures 3 and 4, respectively.

A detailed description of fabrication and engine assembly is presented in the Test and Certification Plan, Volume III, Report E, and the Manufacturing Program, Volume V, Report G. Test planning and integration of fabrication and assembly is presented in Test, Volume IV, Report E.

PREVIOUS BASE WAS BLANK, THEREFOR WAS NOT FILMED.



PWA FP 66-100 Volume V

FD 17860 VH

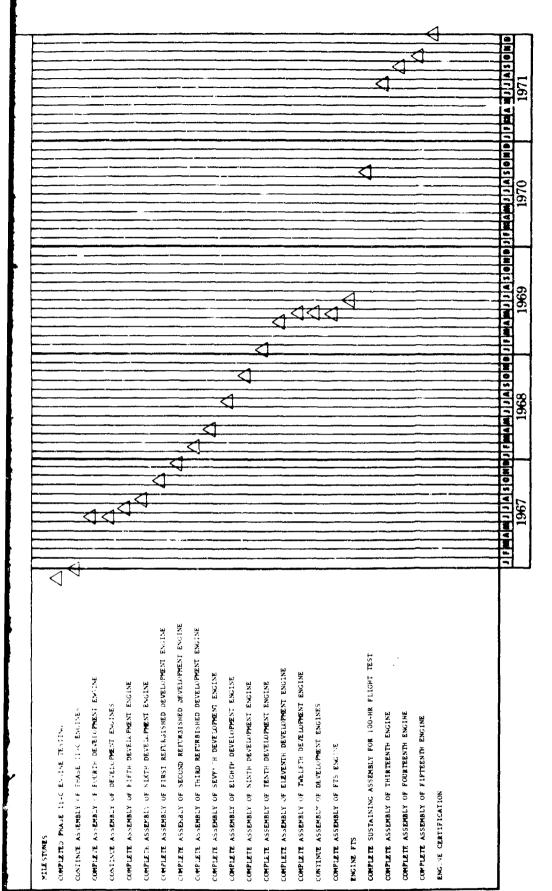
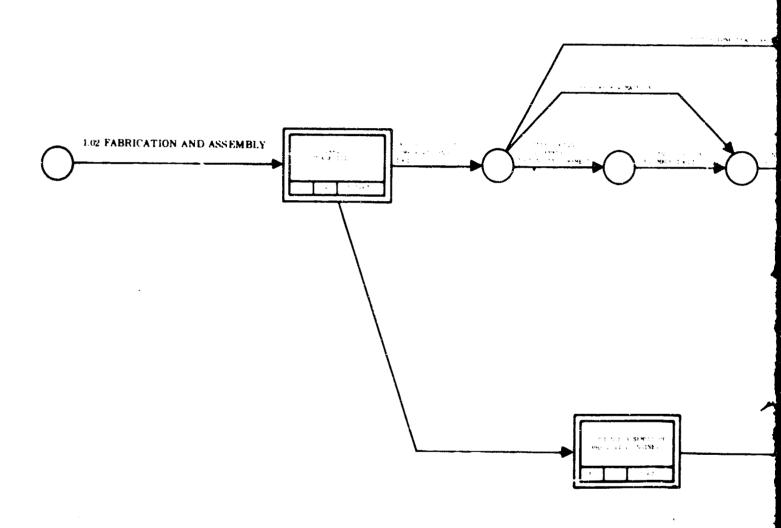
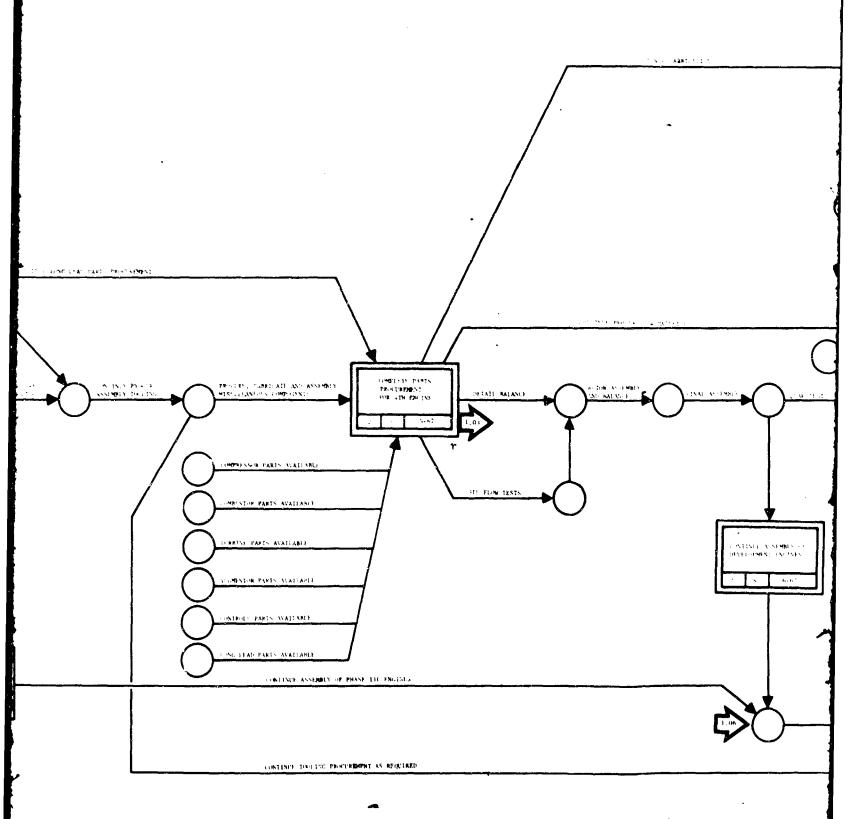
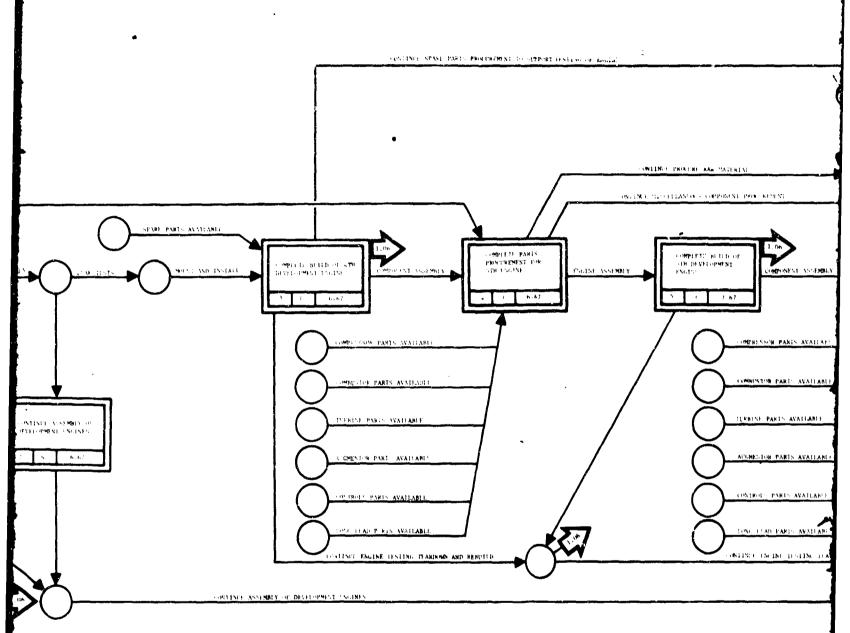


Figure 3. 1.02 Fabrication and Assembly







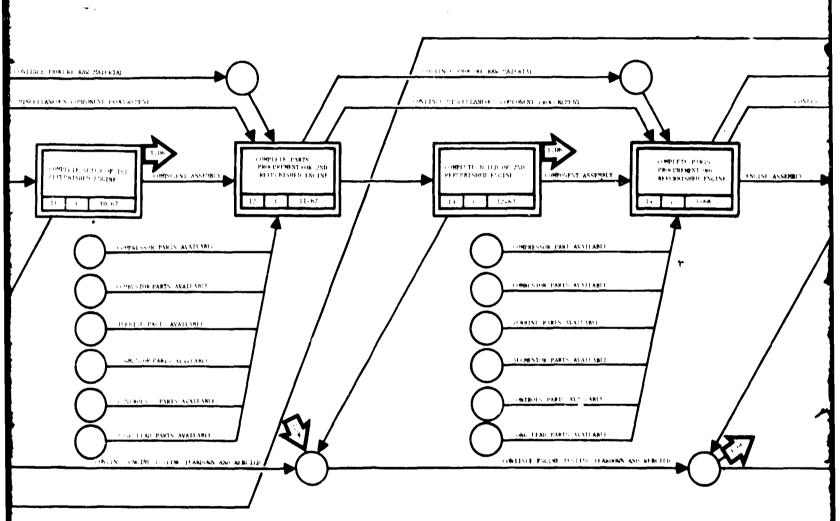
For Salario

CHILD INC. RECEIPED AND ADMINISTRATION OF THE PROPERTY OF T

COMPANIE TANE MIN NEMEN COMPANIES CO

COMPLETE MITTING OF THE ACCUMULATION OF T

CONTINUE SPAKE PARTS PROCUREMENT TO SUPPORT JESTING OF ENGINE



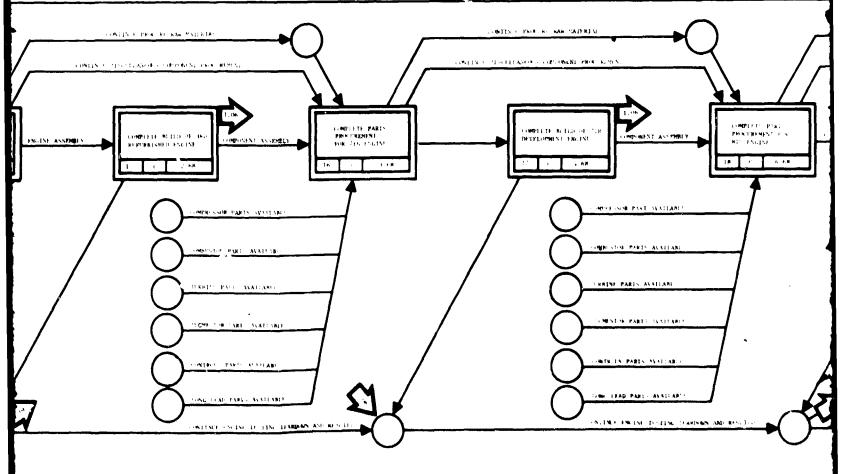
•				
the contract of the third of the contract of t	Record Hamboo	the development of the section of	From a clar	96
No. 100	1	CONTINUE & DIMBOR OF POLICE DE COMMENT		OME 115 FAR 1 FRO REMAS
and the second of the second o		contract of the Hiller of the		Participation of the second
1.		grow to the first of the first of the control of th	_	1 m
I			 .	and the second second second second second
THE CASE OF SECTION CONTRACTOR SECTION CONTRACTOR		CONTINUE CONTINUES A CONTINUENCE AND AND AND AND		
and the second of the second o		and the second of the second o		Assessed the second of the property of the pro
the state of the s		with its think		** * *
•				•
£	•	EXPANSED TO BANCO ENGINE MEMORY CONTROL OF A NOTICE		
रिमाहर का अन्य प्रदेश विकास स्थापन विकास विका		gradient at the company of the control was to		THE FUT PARTY TRACTOR
windermit in the second of the		and the control of th		the state of the s
produce the control of the section o		the state of the s		and the second s
entre de la composition de servicio de servicio de la composition della composition		COMPLETE DEGLES OF SERVICE SEASON FOR THE ENGINE		
The state of the s		A COMPLETE OF ALL A CAP OF THE CALCULATION AND A CAP OF THE CAP OF		110001119 at 110 to 180 017 0
and the second s		A CONTRACTOR OF THE CONTRACTOR		
				and the second of the second of
		COMPANY OF CARTS FROM MANAGEMENT FOR SIZE WAS RELIGIOUS.		
BEP-1838 NO. 1514 109 - 1314 - 47.8 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		Fath and a company of the company of	16	առաջիչային և Այ հագությամբ համարի
and the second of the second of the second		the the control of the transfer of		the second of the second of
and the second of the second		1 1 1 N 10 x 4xx		The second secon
				30 x 2 1 2 4 40 2
	1	CONTRACTOR OF CONTRACTOR OF THE CONTRACTOR OF TH		

e a weeke fig. 18 of the fig. of the first of the fig. 18 of the f

4 71330111017

PORT LESTING OF ENGINES

edinir asambiy of profit field fridges



e en	F = 1 Nove
REMARKS OF MESSAGES AND CONTRACTOR	
And the second s	
Approximate the second	
and the second s	
yeng par maning star 1941 - Tanana sa	
a determinants max. From State	

		150.4	1.81
. gertte	• in	,	er ergennement gewichte.
4 4			
•	٠		
P 1 111	* \ •	7.64	BETTER THE STATE OF THE

principle of the rest street section of the rest of th

Communication of the communica

where the product of the contract of the product o

The property of the property of the control of the property of the control of the

. 11 3 144.1

Section 1. Company of the section of

THE RESERVE OF THE PROPERTY OF

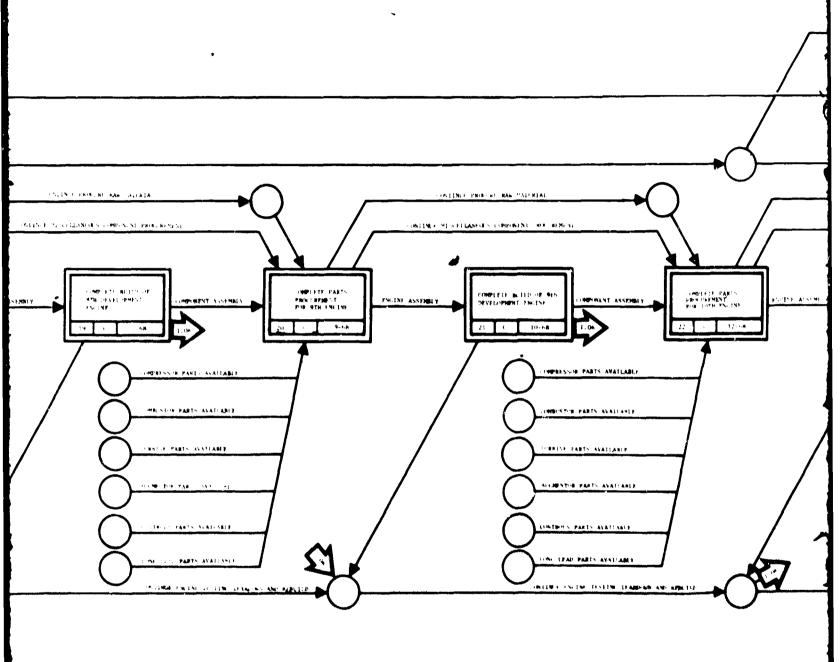
COMPANY PARTY REPORTED TO CONTRACT TO CONT

. The probability of the probab

CONTRACT PROTECTION OF THE CAME OF THE CONTRACT OF THE CONTRAC

Compliants of the second of th

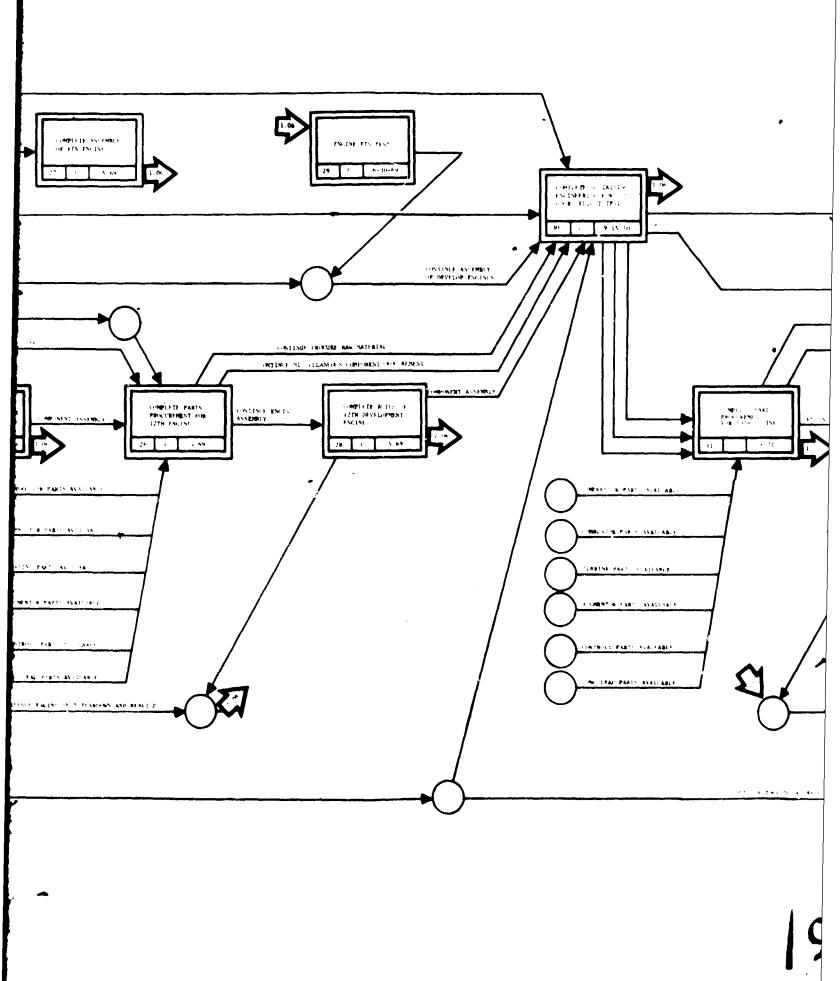


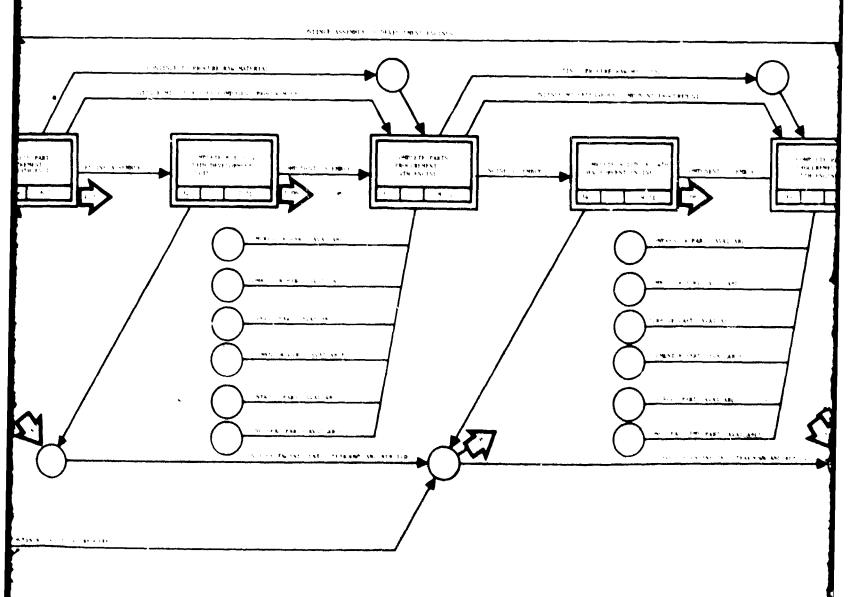


MEINT THE PROPE

		1000 \$ 40	Art 1 45 States	
* , * .	The internal and a real area			
•	THE RIGHT BY THE RESERVE AND A STATE OF THE PARTY OF THE		CHAPTERS FARE CONTRACTOR WAS A COLOR FOR ME	
	the state of the s		 Applying the control of the property of the control o	
	A CONTRACTOR OF THE PROPERTY O		A CONTRACT OF THE CONTRACT OF	
	a Nacional Conference of			
	• The second of		والمحاشية والمناشقة والمناشق المناس المناس المناس المناس	
			And the second of the second o	
			compared the contract of the c	
,	PROPERTY OF THE PARTY OF THE PA			
	Figure 1 (1)	·	 (4) (17) (18) (18) (18) (18) (18) (18) (18) (18	£
	to the second of		The state of the s	.
	Marine with a re-		the second of the second of the second of	<u> </u>
	1-0-0-1274 PARTS PRIS - 0830 N.C. 2100-1118 - 1006-1284			
	The second of the second of the second of		(2) 中間できまり (株分子) (サーバン・597/3) (477年間間 31.3 ままた 54.3	
	was a section of the		Approximate to the control of the co	• 1
	The state of the s		A TOTAL PROPERTY OF STREET	
	community process on a fee day to the the thinks		PM. CM - SEPTER AT LOS	•
	According to the Control of the Cont		But the second of the second o	·
	y to the finance of the second second	•	4 - 4 - 14 - 14	

CONTINUE FABRICATION COMPLETE ASSEMBLY
OF FIS FM 15F ASSEMBLE FTS FROIN ONLINE SPARE PARTS PROCUREMENT TO SUPPORT CHOIND TESTING OF ENGINE NUMBER ASSESSED OF DEVELOPMENT FOR DE CONTINUE PROCURE RAG MOTERIAL TENER MENGETEANNING COMPONENT PROBUMENTS COMPUED BUILDING DITH NEXT MATERIAL INCOME 12-14 21 (1-69 ometrical and the transfer of MYESUS IT ONLINE PRINCESSMENT AN ABLAISMEN





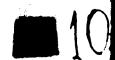
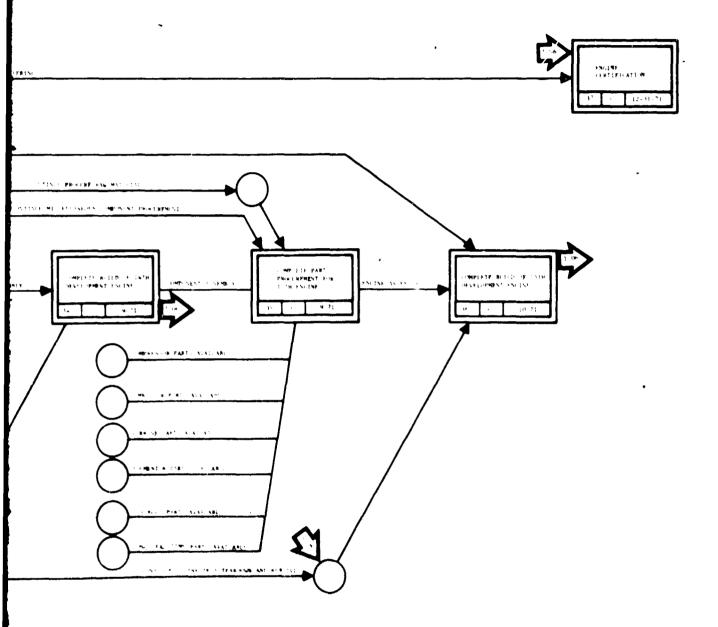


Figure 4.



PWA FP 66-100 Volume V

1.03 TOCLING

Tooling will be designed, procured, inspected and assembled in quantities to meet the schedules of the JTF17 engine development program. The selection of the degree of tooling will be based on the maximum value in tradeoff between labor costs and tooling costs.

Based on experience, engine areas that have a high probability of change are identified, and tooling for such areas is designed as versatile as possible to minimize the cost of obsolescence. Standard tooling and standard methods of gaging are used where possible to reduce the quantity of special tooling required, and to make use of "Catalogue" or shelf-type, low-cost items. Historically, this policy of minimal tooling and gaging for the construction of development engines has proved to be most economical and has resulted in an ability to incorporate Engineering Changes in the minimum time.

The fabrication of development tooling is predominantly subcontracted with the most critical or urgently required tooling being made by Pratt & Whitney Aircraft. New tooling is always thoroughly inspected and tool tryout carefully monitored by the Process Planning and Tool Design Department and Shop personnel to insure that quality requirements are met and that the tool functions as intended.

To determine the type, quantity, and cost of tooling required for the "in-house" manufacturing activity, preliminary drawings will be provided to each process planning group as required. Operation sheets will be prepared denoting operation sequence, description of work to be performed, type of manufacturing equipment to be employed, special tooling required, and a graphic illustration of the operation when necessary for clear direction.

Assembly tooling requirements such as special wrenches, pushers and pullers, balance tooling, spin pit arbors, handling stands, hoists, etc., originate from the Assembly Planning Section of Process Planning from a study of the engine layouts. 'Make or Buy' decision, subcontracting, manufacture and inspection are handled in the same manner as other shop tooling.

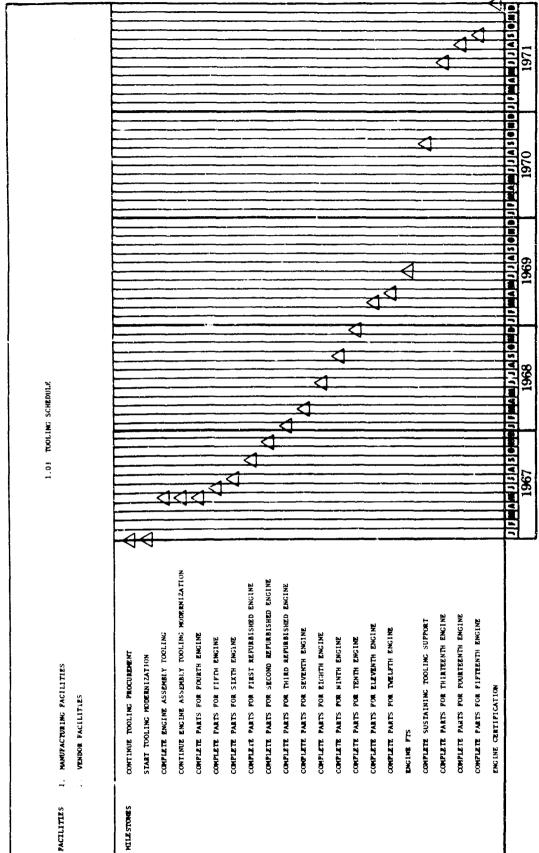
Subcontractor tooling for the development phase will also be as universal as possible. Tooling requirements can be held to a minimum by manufacturing parts in the subcontractor's experimental shops, utilizing tool room techniques and universal machines. The FRDC Purchasing Department is always in a position to evaluate new tooling requirements for the development phase through updated knowledge of subcontractors equipment and machinery. This assures that changes are accomplished economically.

The major milestones, network chart and event dictionary for tooling are shown in figures 5 and 6, respectively.

A detailed description of tooling is presented in the Test and Certification Plan, Volume III, Report E and the Manufacturing Program, Volume V, Report G. Test planning and integration is presented in Test, Volume IV, Report E.

PWA FP 66-100 Volume V

FD 17861



C

Figure 5. 1.03 Tooling

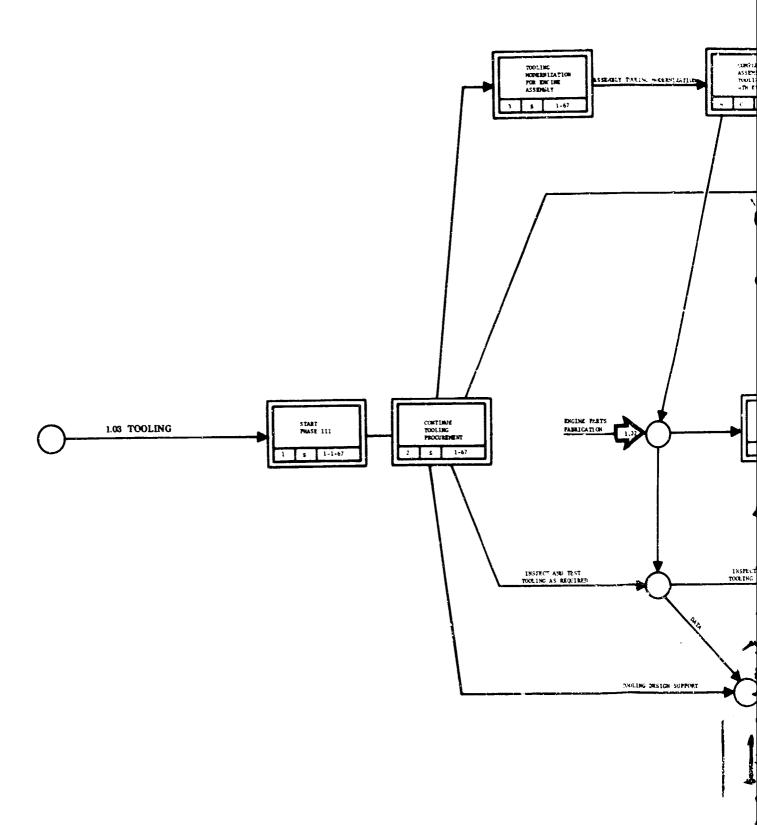
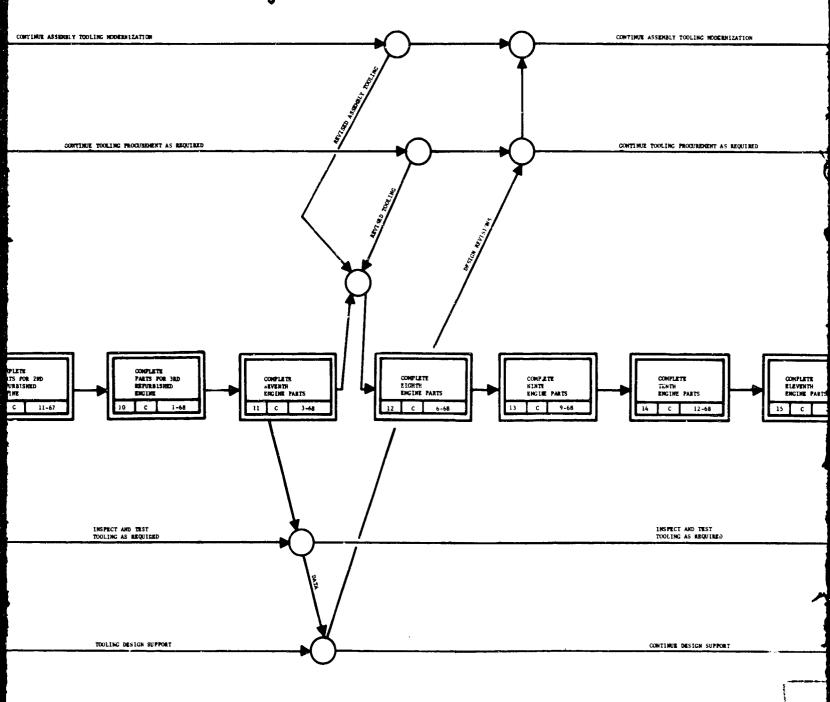


Figure 6. 1.03 Tooling

$\mathbf{\Omega}$
1
4

Event Humber	Description and Criteria	Event Number	Description and Criteria
	START PHASE III. Phase III go-shead received from FAA.	•	COMPLETE 4TH ENGINE PARTS Complete tabrication of parts for 4th development engine. Parts are delivered to Stores or Assembly.
, ,	CATING TOOLING PROCURENENT Continue production of of fooling to fabricate development engine parts. Phase III go-sheed received from FAA.	6	COMPLETE ON PRESING PARTS Complete tabracation of parts for 5th develop- ment engine. Parts are delivered to Stores or Assembly.
,	TOWLING HODERSTEATION FUR ENGINE ASSEMBLY Begin modernization of rooting for development engine assembly. These III go alread received from PAD.	t	COMPLETE OTH ENGINE PARTS Complete fabrication of parts for bth develop- ment engine. Parts are delivered to Stores or Assembly.
4	COMPLETE ASSEMBLY YOULDED FOR ATH EMCINE Complete manufacture of conting required for assembly of the 4th engine. Tooling is delivered to Stores or Assembly.	ē	COMPLETE MARTS FOR 1ST MERPHERISMED ENGINE Complete fabridation of parts for lef engine to be refurbished. Parts are delivered to Stores or Assembly.

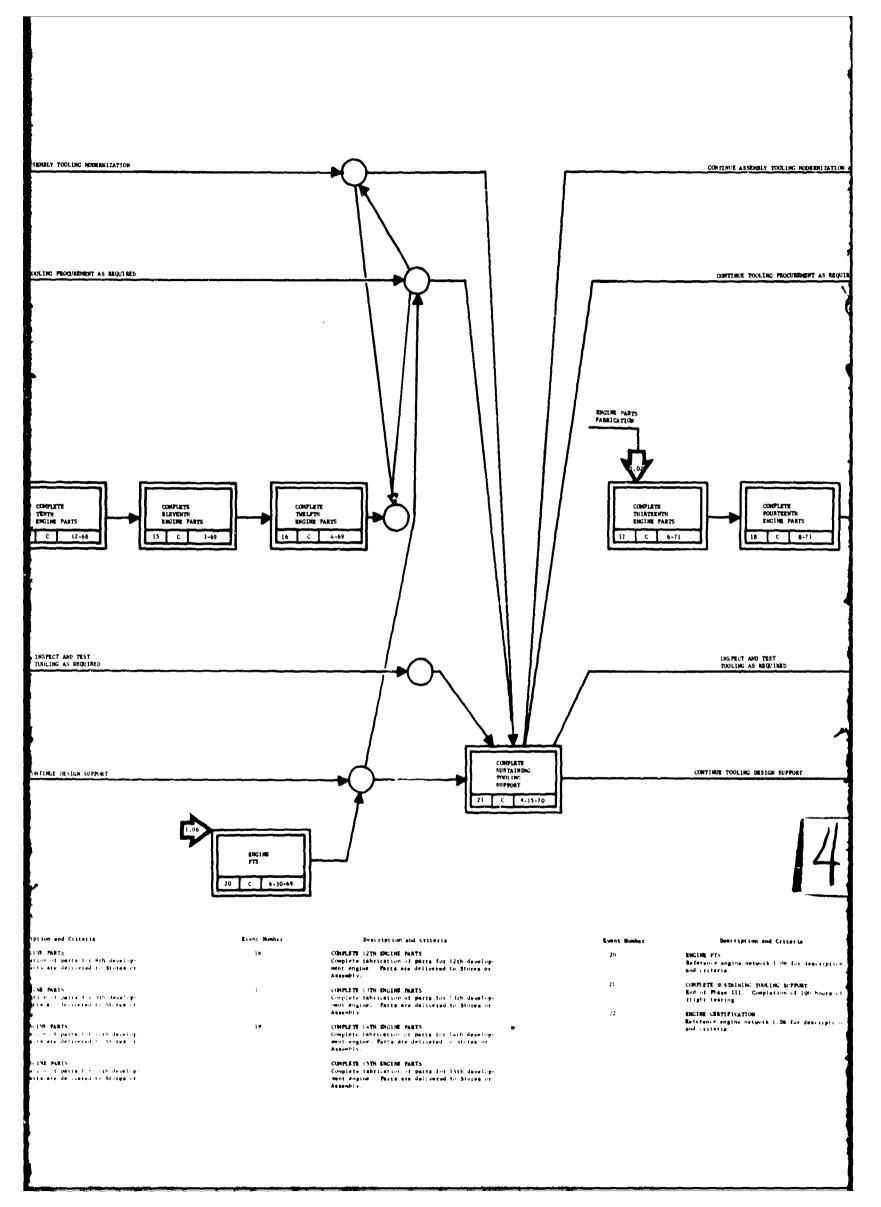
1.03 Tooling

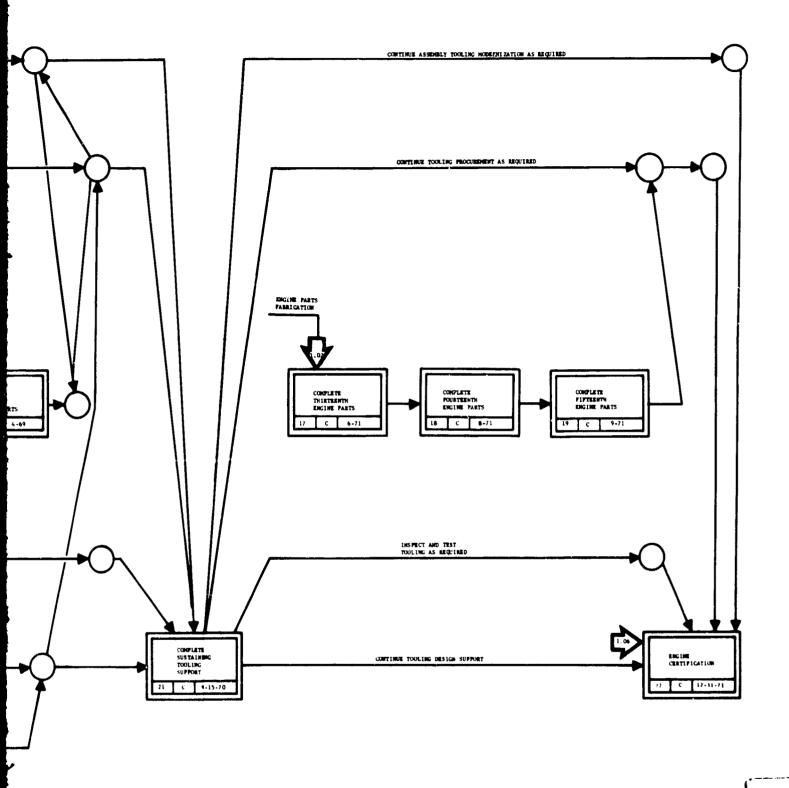


EVEN	T		DICTI	ONARY
3	n	1	TOVE	1241

EVEN	ī	u	uc	7.7	UNA.
1.	0	3	то	UL.	ING

	Event Number	Description and Criteria	Event Number	Description and Criteria
.th develop- Stores or	Ÿ	COMPLETE PARTS FOR 2MD REPURBISHED ENGINE Complete Cabrication of parts for 2nd engine to be returbished. Parts are delivered to Store? or Assembly.		COMPLETE STH ENGINE PARTS Complete Enbrigation of parts for 8th develop- on' engine. Parts are delivered to Storge or Assembly.
en avvelop- e Stores or	10	COMPLETE PARTS FOR 3RD REFURBLISHED ENGINE Complete tabilization of parts for 3rd engine to be refarblashed. Parts are delivered to Stores or Assembly.	1)	COMPLETE OTH ENGINE PARTS Complete Individualism of parts for 6th development engine. Yercs are delivered to Stores of Assembly.
orn develop- Stores or	11	COMPLETE /TH ENGINE PARTS Complete fabilitation of parts for 7th development engine. Parts are delivered to Stores or Assembly.	:•	COMPLETE LOTH ENGINE PARTS Complete Tablesaction of parts for 19th development engine. Parts are delicated to Stores of Assembly.
ENGINE let engine to ed to Stores			D	COMPLETE LITH ENGINE PARTS Complete Tablication of parts for lith development engine. Parts six delivered to Stores of Assembly.





Drecription and Litteria

CUMPLETE 12TH ENGINE PARTS complete fabrication of parts for 12th development engine. Parts are delivered to Stoirs or "Assembles."

COMPLETE LYDE ENGINE THAT'S complete tablication of parts for Lith develop-word engine. Parts are delivered to Stores or Assembly.

COMPLETE DATA DALINE PARTS complete tablication of parts for Jath development engine. Parts are debaseled to States or Assemble.

CONTEST OF ENGINE PARTS
Complete (abilitation of parts for 15th developrect engine - Parts are delivered to Sycres or
Assemble:

Event Bunker	Beecription and Criteria		
20	ENCINE PES		
	Reference engine network 1.06 for description		
	and criteria		
21	COMPLETE SUSTAINING TOURING SUPPORT		
	End of Phase III Completion of 100 hours of		
	flight testing		
22	ENGINE CERTIFICATION		
	Reference engine network 1 06 for description		
	and ritaria		

Pratt & Whitney Aircraft
PWA FP 66-100

Volume V

PWA FP 66-100 Volume V

1.04 ENGINE INSTRUMENTATION

The JTF17 engine development requires the accurate measurement of gas and metal temperatures, gas and fluid pressures and flow rates, and thrust. Engine durability requirements necessitate the accurate measurement of vibration, position, and stress data.

In the application of instrumentation the following conditions must be met:

- 1. Instrumentation must not affect the performance of the engine under test, or alter the properties of the material to which the instrumentation is attached
- 2. Instrumentation must provide data of sufficient accuracy to satisfy the test requirements
- 3. Instrumentation must be durable enough to provide data for a period of time commensurate with objectives.

The development of advanced turbofan engines, such as the TF33-P-7, JT8D, and the high Mach number J58, have made it necessary to maintain a high-level program of instrumentation development. The techniques and experience acquired in the development of these engines are now available for the JTF17 engine program.

The JTF17 engine will be equipped with a flight instrumentation system capable of providing accurate and reliable indications of critical engine parameters for airframe readout, ground checkout, and use in the Airborne Integrated Data System. The accuracy, response rate, and signal level characteristics for this instrumentation will be coordinated with the airframe manufacturer and airlines during Phase III to assure compatibility with the airframe systems and engine functions requiring monitoring. The JTF17 engine provides the instrumentation to measure the following parameters:

- 1. Turbine exhaust pressure
- 2. Turbine exhaust gas temperature
- 3. Duct heater nozzle position
- 4. Reverser-suppressor position
- 5. Aerodynamic brake position
- 6. Secondary air valve position
- 7. Low rotor speed.

In addition, the engine has provisions for the installation of the following instrumentation:

- 1. High rotor speed tachometer
- 2. Oil-in temperature
- 3. Oil pressure
- 4. Primary gas generator fuel flowmeter
- 5. Duct heater fuel flowmeter
- 6. Oil filter differential pressure
- 7. Fuel filter differential pressure
- 8. Vibration pickup mounting brackets (2)
- 9. Fuel pump inlet pressure
- 10. Fuel pump inlet temperature.

PWA FP 66-100 Volume V

The flight instrumentation components provide airframe connectors as indicated on the Installation Drawing. These components are mounted directly on the engine and are exposed to high ambient temperatures, engine vibrations, and acoustical noise. Accordingly, they will be subjected to thorough development programs as individual units and as part of the complete engine system.

Component testing will be conducted at P&WA and the vendor facility to develop each component to meet its requirements of simplicity, accuracy, reliability, and maintainability. These tests will include electrical outputs, vibrations, acoustics, environmental, special tests of electrical interference generation and susceptibility, explosion proof, humidity, and impact.

Automated digita! data systems have been applied to jet engine development testing at FRDC since 1958. Two data systems, serving engine and component test stands, have produced an average of 2.6 million data points per month over the last two years. Reliable and consistent data have been taken at environmental conditions in excess of Mach 3.0. Included as a part of the systems is an on-line computer used to process raw data into engineering units. Computed performance parameters such as TSFC, simulated altitude, Mach number, exhaust gas temperature, EGT profiles, component efficiencies, and airflow are displayed to the test stand control room while the test is in progress within two to three minutes from the time of recording.

The Instrument Laboratory is equipped and staffed to develop, maintain, and calibrate all types of precision instruments required for propulsion system, component development, and performance measurements. Equipment is available for measuring and recording fuel flow, thrust, speed, pressure, vibration stress, chemical composition, heat transfer, and numerous other variables associated with powerplant evaluations.

The engineering staff provides the technical direction for the work of the Instrument Laboratory, has responsibility for providing all necessary specialized measuring instruments, plans and supervises the assembly of complex measurement and recording systems, and does the actual measurement and analysis in cases where specialized experience is necessary.

The major milestones, betwork chart and event dictionary for engine instrumentation are shown in figures 7 and 8, respectively.

A detailed description of engine instrumentation is presented in the Test and Certification Plan, Volume III, Report E. Test planning and integration is presented in Test, Volume IV, Report E.

Pratt & Whitney Aircraft
PWA FP 66-100
Volume V

FD 17862

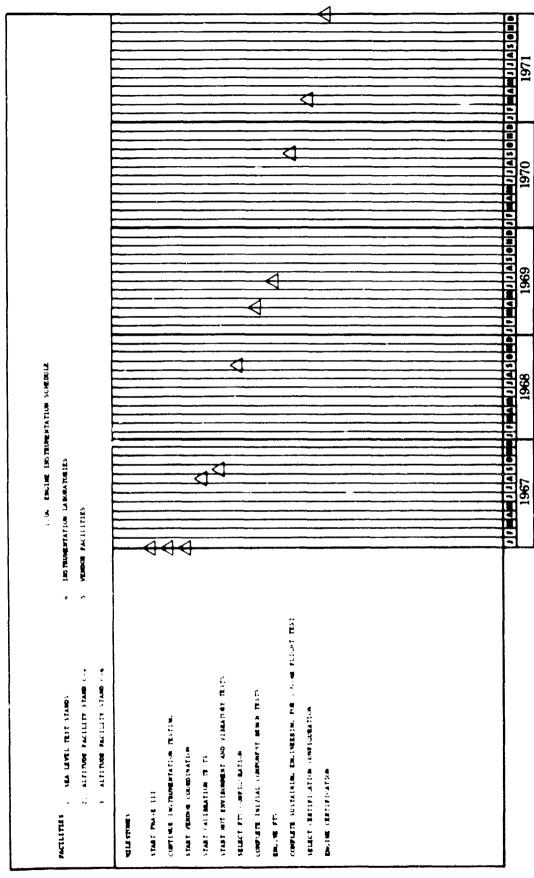
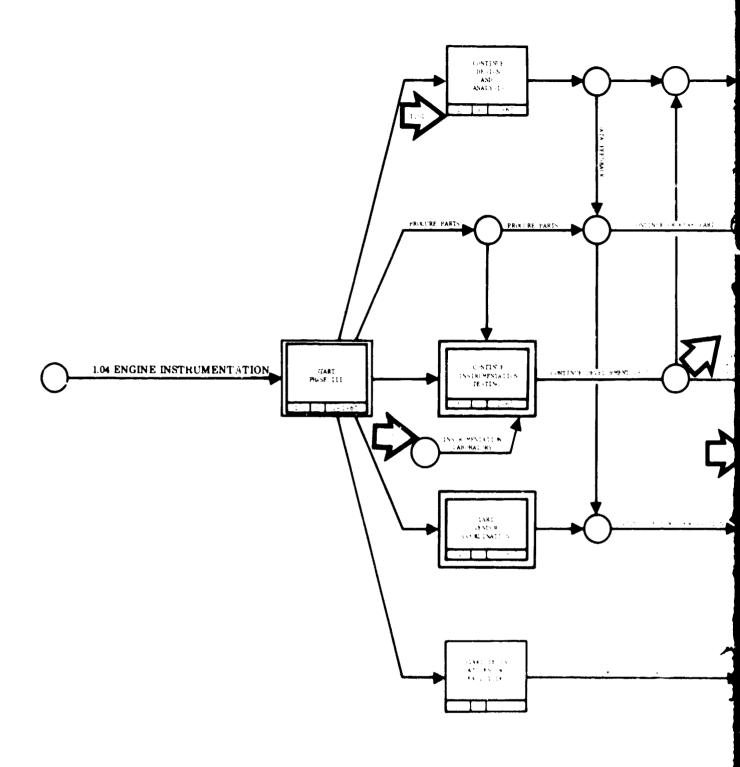
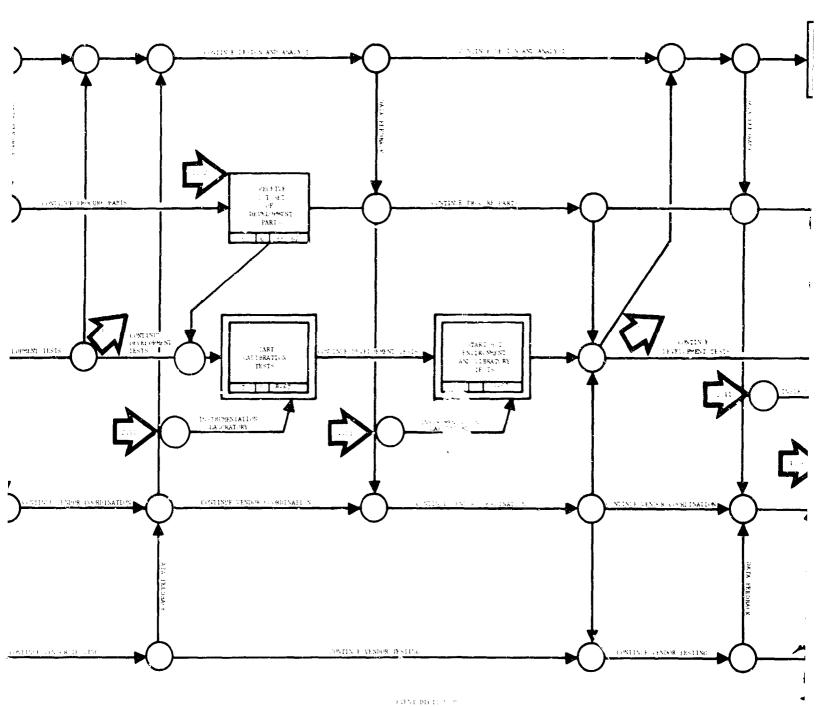


Figure 7. 1.0% Engine Instrumentation



1.04 Engine Instrumentation



Description of two territors	Esserat Number	Description and Criteria	the the second	Pek a pr
Table 17 A 1 To 12 The control of the control of the CAA The control of the control of the CAA	,	REGISTE OF LEGGED OF THE STATE		Photose Files References and construction and the files
[18] J. A. Sangara, M. W. B. Wall, T. B. Sangara, A. Sangara, A		GART CHICKLIST II. Batta a salarati dascenti ta salarati		COMMENT OF LANDING AND FELL OF THE ACCOUNT OF THE A
Professional Company of the Company	,	Control of the State of the Control of the State of the S		distribution for the second
		All the second s		4 · · · · · · · · · · · · · · · · · · ·
		And the second s		Probability of the probability of the second
		Complete and the control of the cont		:

strumentation

5.500

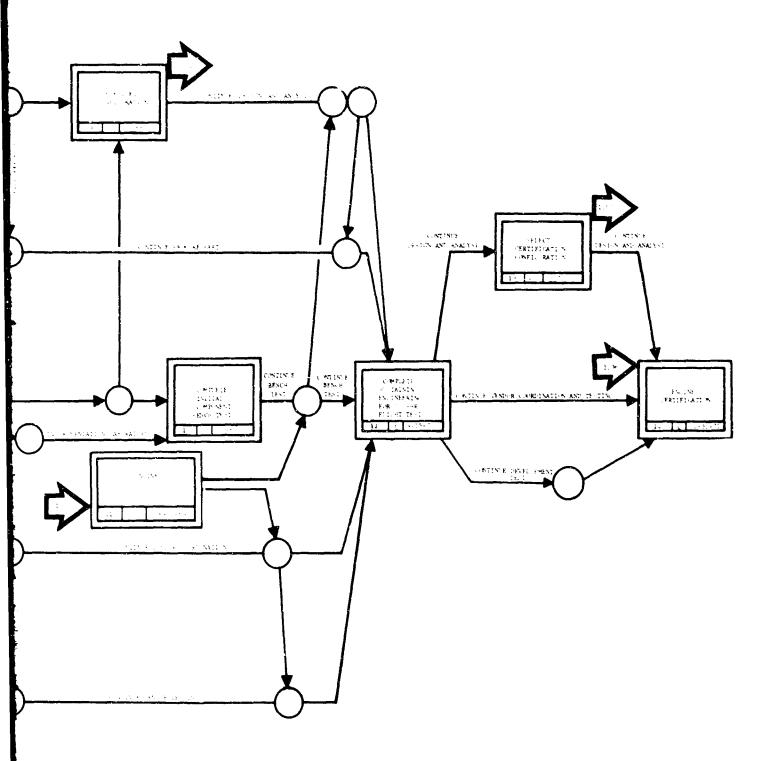
The first of a second of the

And the second of the second o

Section 1. Section 1. Property of the property of

Service Control of the Control of th

Definition of the content of the conte



in 1,000

Pratt & Whitney Aircraft
PWA FP 66-100
Volume V

PWA FP 66-100 Volume V

1.05 TEST EQUIPMENT

Facilities Engineering provides the necessary test facilities required to meet test requirements outlined in Phase III of the Supersonic Transport engine program. A complete description of the facilities utilized in Phase III for the JTF17 engine program is contained in Volume V, Report B. Responsibilities of Facilities Engineering are as indicated below:

- 1. Facilities Engineering have under their cognizance a Facilities Design Engineering Group responsible for P&WA facility designs, and for the development of design criteria for distribution to architectural engineering firms.
- Once the design of a facility is established, it is the responsibility of Facility Engineering to initiate procurement through a Materials Control Group, utilizing Government reserve equipment screening where available through DIPEC.
- 3. Installation of all test equipment is accomplished by separate purchase order to an installation contractor, under the direction of the responsible Facility Engineer.
- 4. Checkout and inspection of all test equipment is under the supervision of Facilities Engineering during the final phase of construction, in coordination with the Inspection and Test Operation Departments.

The test stands utilized in Phase III of the JTF17 engine program are as follows.

A. Sea Level Engine Calibration and Endurance Test Facilities

A total of nine sea level test stands are required to conduct the JTF17 engine program, including three with heated inlet capability. Five existing FRDC stands will be available and capable, with modifications, of testing the JTF17 engine. These stands are A-3, A-4, A-5, A-6, and A-7. Four new stands, A-9, C-8, C-9, and C-10 will be built.

B. Simulated Altitude and Mach Number Engine Test Facilities

A total of three simulated altitude and Mach number engine test facilities are necessary to conduct the testing required for the JTF17 engine program. In these facilities, flight envelope conditions can be simulated. At FRDC one existing test stand is available for testing the JTF17 engine and one new test stand, C-6, will be constructed. One existing stand in the Andrew Willgoos Turbine Laboratory, X-210, will be modified to conduct testing on the JTF17 engine.

PWA FP 66-100 Volume V

C. Simulated Altitude and Mach Number Component Test Facilities

1. Fan and Compressor Facilities

Two full-scale fan and compressor test stands are necessary for the JTF17 program. Each will be capable of testing single-stage, multistage, and complete compressor units over a wide range of simulated altitude and Mach number conditions. One existing test stand, C-3, will be available for the JTF17 program. An additional stand, C-7, will be constructed.

2. Turbine Rig Test Stands (Available)

Two test stands are available for turbine component testing for the JTF17 program. These stands are used to investigate and develop turbine blade and vane materials and cooling configurations.

D. Small Components Facilities

Twenty-eight small component stands and benches will be used for the JTF17 program. They will be used in testing complete control systems and subcomponents, ignition systems and such mechanical components as oil pumps, gearboxes, bearing and seal systems and other engine auxiliary equipment.

The major milestones, network chart and event dictionary for test equipment are shown in figures 9 and 10, respectively.

A detailed description of test equipment is presented in the Facilities Program, Volume V, Report B. Test planning and integration of the test equipment is presented in Test, Volume IV, Report E.

PWA FP 66-100 Volume V

FD 17863

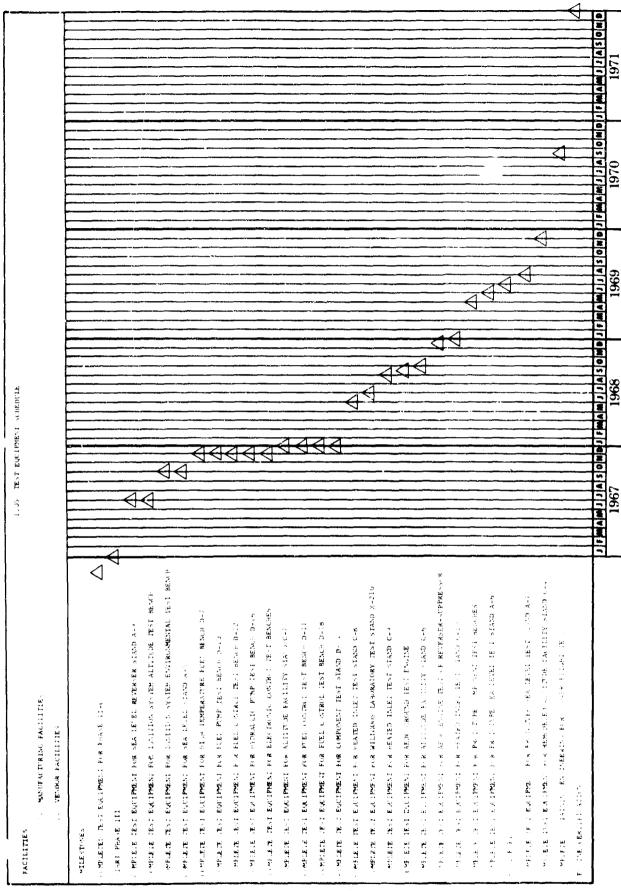
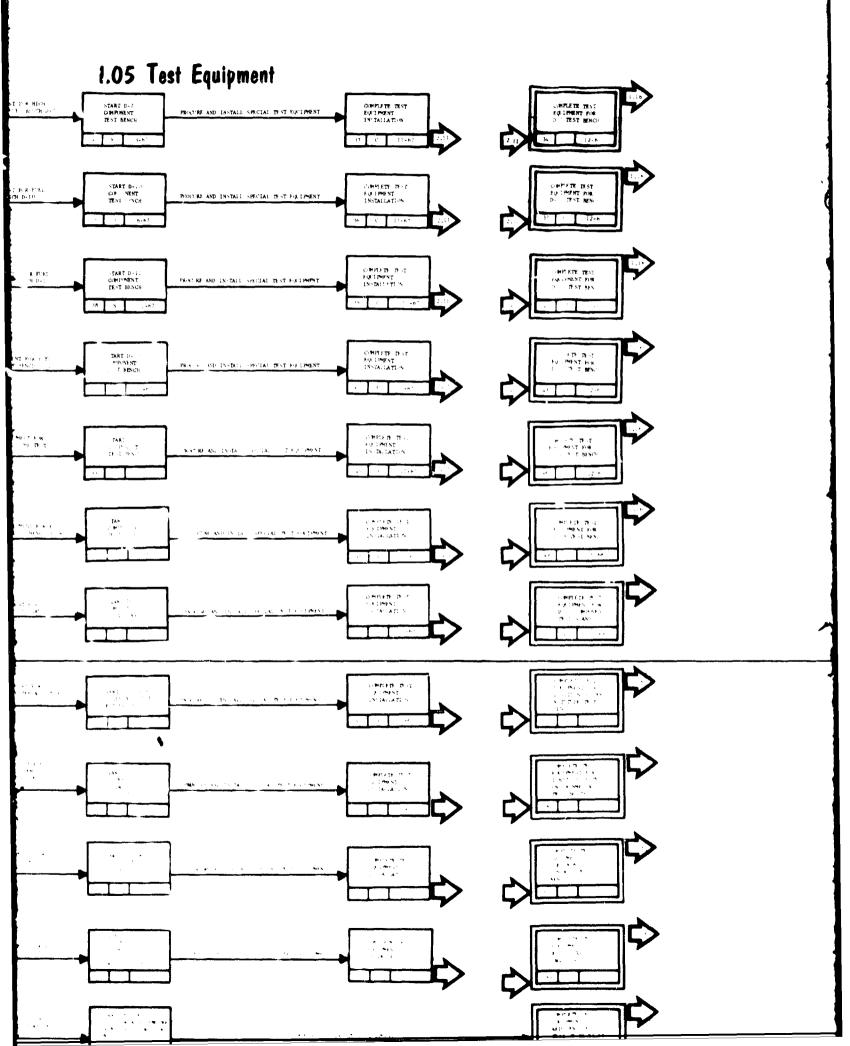
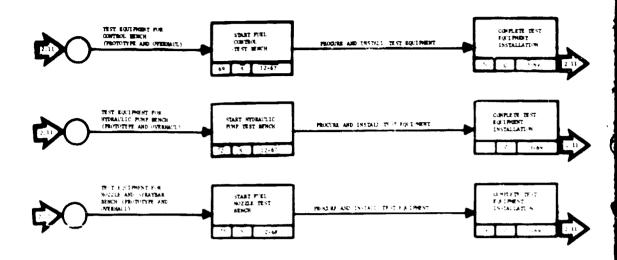
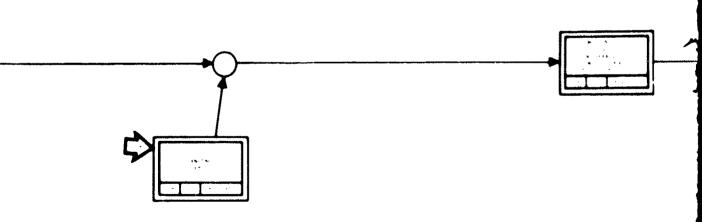


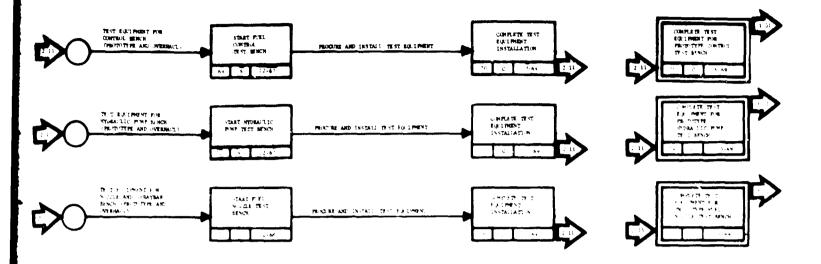
Figure 9. 1.05 Test Equipment

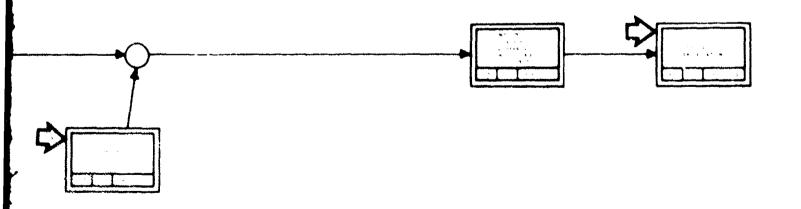


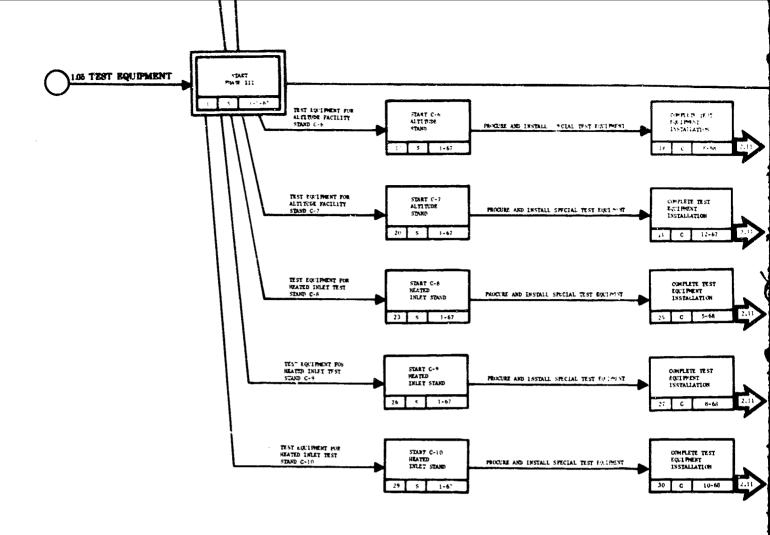




PWA FP 66-100 Volume V







ent Simber	Description and Criteria	Event Nather
ī	START PHASE III Start of These III Thase III go-shead received from PAA.	10
2	START A-5 SEA LEVEL STARD Initiate design and procurement of the neces- abry special test equipment for A-5 sea level engine test stand. Design and procurement are in progress.	11
	COMPLETE TEST EQUIPMENT INSTALLATION Complete the unstablistion of special test equipment on A-5 tost stand. Test stand is ready for final checkout.	12
4	COMPLETE TEST EQUIPMENT FOR A-5 STAND Complete checkout of test equipment during final chackout of test stand. Operate engine.	13
5	START A-6 SEA LEVEL STAND Initiate design and procurement of the necessary special test coulement for A-6 sea level engine test stand. Design and procurement are in progress.	14
6	CONFIGER TEST EQUIPMENT INSTALLATION Complete the installation of special cost equipment on A-6 cost stand. Test stand is ready for final checkost.	11
7	COMPLETE TEST RQUIFMENT FOR A-6 STAND Complete checkout of test equipment during final checkout of test stand. Operate engine.	17
•	START A-7 MA 'EVEL STAMP Initiate design and procurement of the neces- nary special test equipment for A-7 see level engine test stand Design and procurement are in progress.	1.8
٠	COMPLEX TEST EQUIPMENT INSTALLATION Complete the installation of special test equip- uent on A-7 test stand. Twet stand is ready for fixel checkbut.	19

Figure 10. 1.05 Test Equipment

Description and Cri

COMPLETE TEST EQUIPMENT FOR A-Complete checkeut of test equi checkout of test stand. Open

START A-9 REVERSER STAND Initiate design and procurency special test equipment for Atest stand. Design and procuprogress.

COMPLETE TEST EQUIPMENT INSTA Complete the installation of ment on A-9 test stand. Trat final checkout.

C'MPLITE TEST EQUIPMENT FOR A Complete checkout of test equipment of test stand. Operations

START C-4 ALTITUDE "D RFTG Initiate design and procuremal special test equipment for Catand. Design and procurement

COMPLETE TEST EQUIPMENT INSTA Complete the installation of sent on C-4 test stand. Test final checkent.

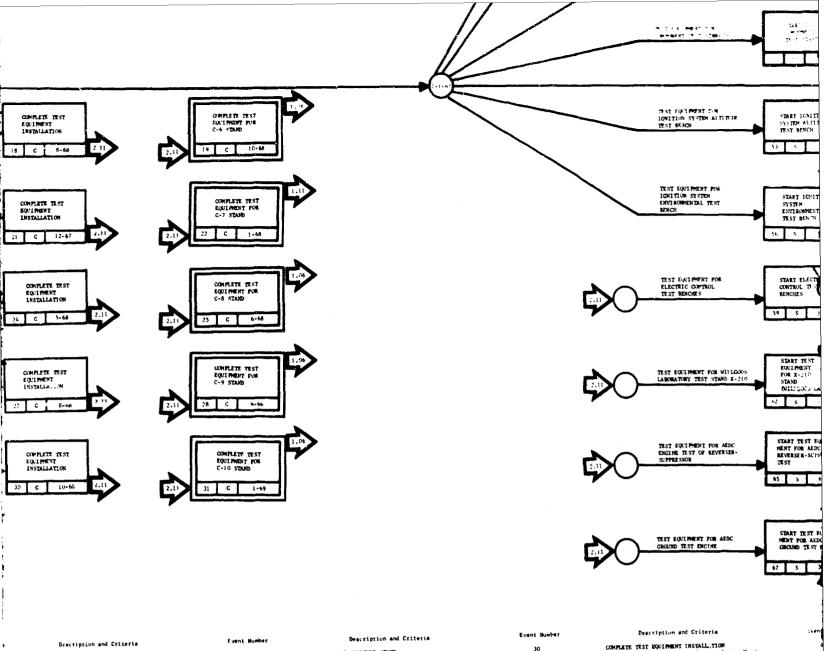
COMPLETE TEST EQUIPMENT FOR C Complete checkout of test equi checkout of test stand. Oper

START C-6 ALTITUDE STAND Initiate design and procurery special test equipment for C-Design and procurement are in

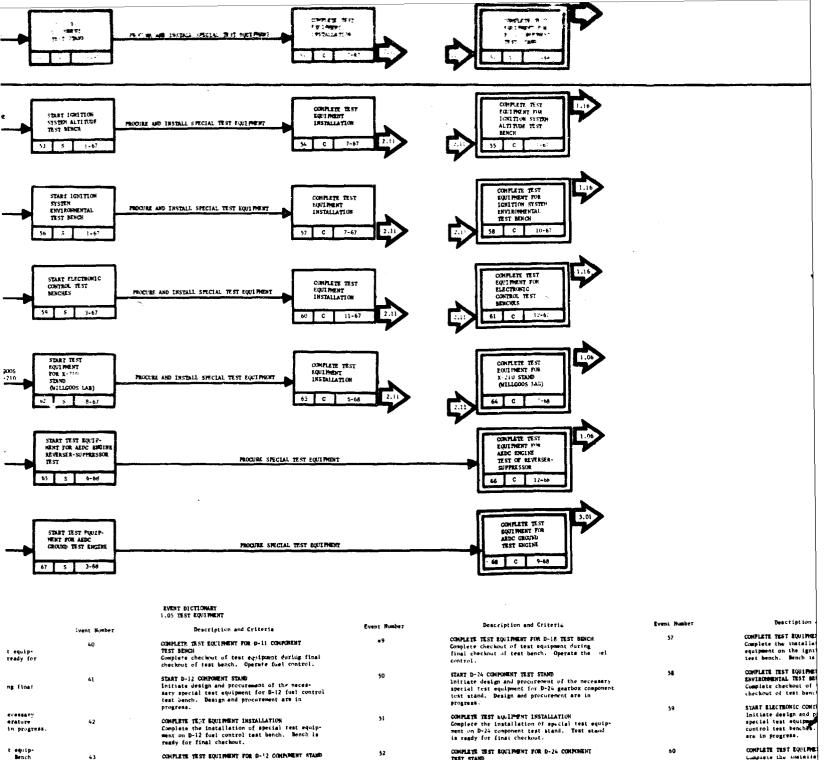
COMPLETE TEST EQUIPMENT INSTA Complete the installation of sent on C-6 test stand. Test for final checkout.

COMPLETE SEST NOW FROM THE Complete checkout of test en checkout of test stand. Open

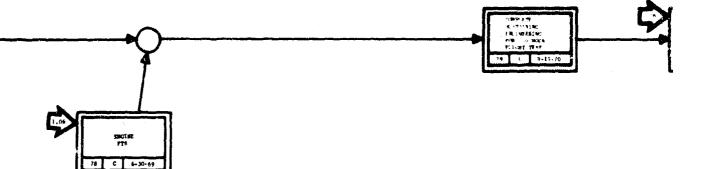




	Description and Criteria	t. Whit believes			COMPLETE YEST EQUIPMENT INSYALL.TION	4
	COMPLETE TEST EQUIPMENT FOR A-7 STAND Complete checkout of test equipment during final checkout of test stand. Operate engine.	20	START C-7 ALTITUDE STAND Initiate design and procurement of the necessary special test equipment for C-7 altitude compo- nent test stand. Design and procurement are	30	Complete the installation of special test "quip- ment on C-16 test stand. Test stand is ready for final checkent.	
	START A-9 REVERSER STAND Initiate design and procurement of the necessary special test equipment for A-9 sea sevel engine	21	in progress. COMPLETE TEST EQUIPMENT INSTALLATION Complete the installation of special test equip-	31	COMPLETE TEST EQUIPMENT FOR C-10 STAND Complete checkout of test equipment during final checkout of test stand. Operate engine.	
	test stand. Design and procurement are in progress.		ment on G-7 test stand. Test stand is ready for tinal checkout.	32	START D-7 CONFUNENT TEST SERGH Initiate design and procurement of the nucessary special test equipment for D-7 high temperature	
	COMPLETE TEST EQUIPMENT INSTALLATION Complete the installation of special test equipment on A-9 test stand. Test stand is ready for	22	COMPLETE TEST EQUIPMENT FOR C-7 STAND Complete checkout of test equipment during final		fiel bench. Design and procurement are in progress.	
	fina; checkout.	23	checkout of test stand. Operate engine.	33	COMPLETE TEST EQUIPMENT INSTALLATION Complete the installation of special test equipment on D-7 high templeacut: fuel bench. Bench	
	COMPLETE IEST EQUIPMENT FOR A-9 STAND Complete electout of test equipment muring final checkout of test stand. Operate engine.	.,	Initiate design and ptocurement of the necessary special test equipment for C-8 heated inlet test stand. Design and procurement are in progress.		is ready for final checkout. COMPLETE TEST EQUIPMENT FOR D-7 COMPONENT TEST	
	START C-4 ALTITUDE STAND REMODIFICATION	24	COMPLETE TEST EUFIPMENT INSTALLATION	34	BENCH Complete checkout of test equipment during final	
	Initiate design and procurement of the mecessary special test equipment for C-G sittinde test stand. Besign and procurement are in progress.		Complete the installation of special test equip- ment on C-8 test stand. Test stand is ready for final chackout.	35	Checkout of bench. Operate component.	,
	COMPLETE TEST EQUIPMENT INSTALLATION Complete the installation of apocial test equipment on Courtest stand. Test stand is ready for	25	COMPLETE TEST EQUIPMENT FOR C-8 STAND Complete checkout of test equipment during final checkout of test stand. Operate engine.		Initiate design and procurement of the necessary special test equipment for D-10 fuel pump test bench. Design and procurement are in progress.	1
•	tinal checkout. CUMPLETE TEST EQUIPMENT FOR C-6 STAND Complete wheekast of test equipment during final checkast of test stand. Operate engine.	26	START C-9 HEATED INLET STAND Initiate dualing and procurement of the necessary apocial test equipment for C-9 heated inlet test stand. Design and procurement are in progress.	36	COMPLETE TEST EQUIPMENT INSTALLATION Complete the installation of special test equipment on D-10 fuel jump test bench. Bench is ready for final checkout.	(
	NYMET C-t ALTITUDE STAND Initiate design and procuroment of the necessary special test expirement for C-b altitude test stand. Design and procurement are in progress.	27	COMPLETE TEST EQUIPMENT INSTALLATION COMPLETE the installation of special test soutp- ment on C+0 test stand. Test stand is ready for final checkmut.	37	COMPLETE TEST EQUIPMENT FOR D-10 COMPONENT TEST BENCH Complete checkout of test equipment diring final checkout of bench. Operate fuel pump.	1
	CUMPLETE TEST EXCIPMENT INSTALLATION Complete the installation of apecial test equipment on Cohice, stand. Test stand is ready for final checkens.	28	COMPLETE TEST EQUIPMENT FOR C-9 STAND Complete checkout of test equipment during final checkout of lest stand. Operate engine.	38	START D-11 COMPONENT SEXT BENCH Initiate design and provincement of the necessary special test equipment for D-11 fuel control test bench. Design and provincement are in progress.	•
•	COMPLETE TEST BUCKMENT FOR C-0 STAND Complete checkent of lost equipment during final checkent of twat stand. Operate engine.	29	START C-10 MEATED INLKT STAMP Initiare design and procurement of the necessary special test equipment for C-10 heated inlet cest stand. Design and procurement are in progress.	39 .	COMPLETE TEST EQUIPMENT INSTALLATION Complete the installation of special test equipment on B-11 feet control test bench. Bench is ready for final checkout.	. 4

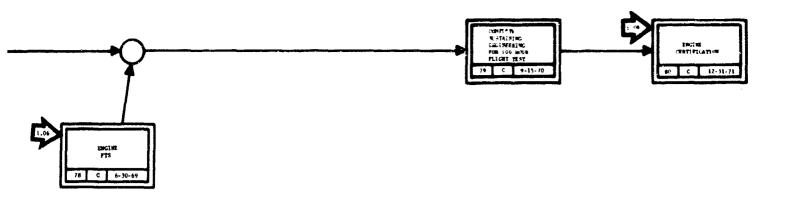


		1.05 TEST EQUIPMENT				
	ivent Number	Description and Griteria	Event Number	Description and Criteria	Event Number	Description
t equip- ready for	40	COMPLETE TRAY EQUIPMENT FOR D-11 COMPONENT TRAY BENCH Complete checkwart of test equipment during final checkwart of test bench. Operate fuel control.	49	COMPLETE TEST EQUIPMENT FIRE D-18 TEST BENCH Complete checkout of test equipment during final checkout of test bench. Operate the sel control.	57	COMPLETE TEST EQUIPMES Complete the installat equipment on the ignst test bench. Bench 14
ng finat	41	START D-12 COMPOWENT STAND Instructe design and procurement of the neces- sary special test equipment for D-12 fuel control cest bench. Design and procurement are in	50	START D-24 COMPONENT TEST STAND Initiate design and productement of the necessary special test equipment for D-24 gearbox component test stand. Design and procurement are in progress.	58	COMPLETE TEST EQUIPME ENVIRONMENTAL TEST BE Complete checkout of checkout of test bench
ecossary erature in progress.	42	progress. COMPLETE TE: T EQUIPMENT INSTALLATION Complete the installation of special test equipment on D-12 fuel control test bench. Bench is ready for final charkout.	51	COMPLETE TEST AULIMENT INSTALLATION Complete the installation of special test equip- ment on D-24 component test stand. Test stand is ready for final checkout.	59	SYART ELECTRONIC CONT Initiate design and p special test equipment control test benches, are in progress.
t equip- Bench	43	COMPLETE TEST EQUIPMENT FOR D-12 COMPLETE STAND Complete checkout of test equipment during final checkout of test bench. Operate the fuel control.	52	COMPLETE TEST EQUIPMENT FOR D-24 COMPONENT TEST STARD Complete checkout of test equipment during final checkout of test stand, Operate gasthox and lubrication system rig.	60	COMPLETE TEST EQUIPME: Complete the installs equipment on the elec- benches. Benches are
ng final	44	START D-16 COMPONENT TEST RENCH Initiate dealign and procurement of the necessary special test equipment for D-16 hydraulic pump test bench. Dealign and procurement are in progress.	53	START IGHITION MYSTEM ALTITUDE TECT BENCH Initiate design and procurement of the necessary special test equipment for the ignition system altitude test bench. Design and procurement	61	COMPLETE TEST EQUIPMENTEST REMOVES Complete checkout of checkout of test benches to the controls.
p test ogress, t equip-	.45	COMPLETE TEST EQUIPMENT INSTALLATION Complete the installation of special test equipment on D-16 hydraulic pump test bench. Bench is ready (or final checkout,	34	OMPLET TEST SQUEPERS, INSTALLATION Complete the installation of special test equip- ment on the ignition system sittude test bench.	62	START TEST EQUIPMENT : LABORATORY) Initiate design and pospecial test equipment stand in the Millgoos
h is	46	COMPLETE TEST EQUIPMENT FOR D-16 TEST RENCH Complete checkout of test equipment during final checkout of test bench. Operate the hydraulic	**	Bench is ready for final checkout. COMPLETE TREE EQUIPMENT FOR LOWITION SYSTEM ALTITUDE TREE BRICH	63	procurement are in pro- COMPLETE TRET BQUIFMEN
NY TEST ng final	47	pump. START D-18 COMPONENT TEST BENCH Initiate design and procurement of the necessary		Complete checkcut of test equipment during final checkcut of test bench. Operate ignition system.		Complete the installs ment on X-210 sitting is ready for Sinal ch
ecessary trol test vgress	48	special test equipment for D-18 fuel control test bench. Design and procurement are in progress. COMPLETE TEST EQUIPMENT INSULLIATION Complete the installation of special test equip- ment on D-18 fuel control test bench. Bench is ready for final chuckout.	36	START IGHTICH SYSTEM ENVIRONMENTAL TEST BENCH Initiate dealign and procurement of the necessary special test equipment for the ignition system environmental test bunch. Dusign and procure- ment are in progress.	4	COMPLETE TEST EQUIPME LABORATORY) Complete checkeut of checkeut of test stan
ench is						



Description and Criteria	Event Humber	Description and Critoria	Event Number	Description and Criteria
COMPLETE TEST EQUIPMENT INSTALLATION	65	START TEST EQUIPMENT FOR AEDC ENGINE REVEASER- SUPPRESSOR TEST	73	COMPLETE TEST EQUIPMENT INSTALLATION Complete the installation of apecial test equip-
Complete the installation of special test		initiate design and procurement of the necessary		ment on the prototype hydraulic pump test bench.
equipment on the ignition system environmental		special test equipment for the ASDC engine test		Bench is ready for final checkout.
test bench. Bench is ready for final checkout.		of the reverse2-suppressor. Design and procure-		Sellen to (vac) t
		ment are in progress.	14	COMPLETE THEY EQUIPMENT FOR PROTOTYPE HYDRAULIC
COMPLETE TEST EQUIPMENT FOR IGNITION SYSTEM		mane are to progress.	,-	PIMP TEST MINCH
ENVIRONMENTAL TEST BENCH	66	COMPLETE TEST EQUIPMENT FOR AEDC ENGINE TEST		Complete checkout of test equipment during final
Complete checkout of test equipment during final	94	OF REVERSER-SUPPRESSOR		checkout of test bench. Operate hydrauite pump.
checkout of test bench. Operate ignition system.		Complete procurement and inspection of the		
	**	necessary test equipment required for the engine	15	START FUEL MOZZIE TEST MENCH
START ELECTRONIC CONTROL TEST BENCHES		test of the reverser-suppressor at ARDC. Deliver	**	Initiate design and procurement of the necessary
Initiate design and procurement of the necessary		test equipment with engine.		special test equipment for a prototype fuel nozal-
special test equipment for two electronic fuel		test starbeste arth autimo.		test bench. Design and procurement are in progres
control test benches. Design and procurement	67	START TEST EQUIPMENT FOR ARDC GROUND TEST ENGINE		• • • • • • • • • • • • • • • • • • • •
are in progress.	47	Initiate dueign and procurement of the necessary	76	COMPLETE TEST EQUIPMENT INSTALLATION
		special test squipment for the first ABDC ground	,-	Complete the installation of special test equip-
COMPLETE TEST EQUIPMENT INSTALLATION		test eagine. Besign and procurement are in		ment on the prototype fuel nozzle test bench.
Complete the installation of apecial test		prograss.		Bench is ready for final checkout.
equipment on the electronic control test		F		•
benches. Benches are ready for final checkout.	68	COMPLETE TEST EQUIPMENT FOR ARDC GROUND TEST	11	COMPLETE TEST EQUIPMENT FOR PROTOTYPE FUEL HOZZLE
	44	ENGINE .	••	TEST BENCH
COMPLETE TEST EQUIPMENT FOR ELECTRONIC CONTROL		Complete procurement and inspection of the		Complete checkout of test equipment during line:
TRET MENCHES		necessary test equipment required for the		checkout of test bench. Operate fuel nonsies.
Complete checkout of test equipment during final		first AEDC ground cost engine. Deliver test		
checkout of test benches. Operate electronic		equipment with engine.	75	ENGINE FTS
fuel controls.		adarbane arm and ann		Reference engine network 1.06 for description
	69	START FUEL CONTROL TEST BENCH		and critoria.
STAR: TEST EQUIPMENT FOR X-210 STAND (WILLGOOD	•,	Initiate design and procurement of the necessary		
ABURATORY)		special rear equipment for a prototype fuel	79	COMPLETE SUSTAINING ENGINEERING POR 100-HOUR
initiate design and procurement of the necessary		control test beach. Design and procurement are		FLIGHT TEST
apecial rest equipment for X-210 altitude test		in progress.		End of Phase III. Completion of 100 hours of
atend in the Willgoom Laboratory. Design and		• •		flight testing.
procurement are in progress.	70	COMPLETE TEST EQUIPMENT INSTALLATION		
		Complete the installation of special test equip-	80	RHGINE CERTIFICATION
COMPLETE TEST EQUIPMENT INSTALLATION		ment on the prototype fuel control test bench.		Reference engine network 1.06 for description
Complete the installation of aperial fast equip-		Seach is ready for final checkput.		and critoria.
ment on X-210 eltitude test stand. Test stand is ready for finel checkeut.		*		
IS ESSENT FOR TIMES CHRESTONE.	71	COMPLETE THE PROPERTY FOR PROTOTYPE CONTROL		
COMPLETE TEST EQUIPMENT FOR X-210 STAND (VILLADOS	· -	19A1 MENCH		
STRUCT COLL EGG LANGEL AND V-110 REGIO (ALFORDOR		Complete sheehout of test equipment during final		
Complete checkout of test equipment during finel		checkent of test bonch. Operate fuel control.		
cherkout of test stand. Operats engine.				
cuerrant at tant broug. Abstata auffres.	72	START MYDRAULIC FUND TEST BENCH	•	
	,	Interest during and procurement of the personally		





Event Humber	Description and Criteria	Event Number	Description and Criteria
65	START TEST EQUIPMENT FOR AEDC ENGINE REVERSER- SUPPRESSOR TEST Initiate design and procurement of the necessary special test equipment for the AEDC engine test	73	COMPLETE TEST EQUIPMENT INSTALLATION Complete the installation of special test equip- ment on the prototype hydraulic pump cest banch, Banch is ready for final checkout.
	of the reverser-suppressor. Sweign and Procure- ment etc in progress.	74	COMPLETE TEST EQUIPMENT FOR PROTOTYPE HYDRAULIC FRINP TEST MENCH
66	COMPLETE TEST EQUIPMENT FOR AEDC ENGINE TEST OF REVERSER-SUPPRESSOR Complete procurement and inspection of the		Complete checkout of test equipment during final checkout of test bench. Operate hydraulic jump.
	necessary test equipment required for the engine test of the reverser-suppressor at AEDC. Deliver test equipment with engine.	75	START FUEL NOZZLE TEST MEMCH Initiate design and procurement of the necessary special test equipment for a prototype fuel nozzle test bench. Design and procurement are in progress
67	START TEST EQUIPMENT FOR AERC GROUND TEST ENGINE Initiate design and procurement of the necessary special test equipment for the first AERC ground test makine. Design and procurement are in progress.	76	COMPLETE TEST EQUIPMENT INSTALLATION Complete the installation of special test equipment on the prototype fuel nossle test ch. Bench is ready for limit checkout.
48	COMPLETE TEST EQUIPMENT FOR AEDC GROUND TEST ENGINE. Cumpleto procurement and inspection of the necessary test equipment required for the first AEDC ground test engine. Deliver test	n	COMPLETE TEST EQUIPMENT FOR PROTOTYPE FUEL NOZZLE TEST SERCH Complete checkout of test equipment dur ng final checkout of test bench. Operate fuel nozzles.
49	equipment with engine. TRAT PURL CONTROL TRAT MENCH	70	RNGIME PTS Reference ongine network 1.06 for description and criteria.
•	Initiate design and procurement of the necessary special test equipment for a prototype fuel control test bench. Design and procurement are in progress.	79	COMPLETE SUSTAINING ENGINEERING FOR 100-NOVE FLIGHT TEST End of Phase 111. Completion of 100 hours of flight testing.
70	COMPLETE TEST EQUIPMENT INSTALLATION Complete the installation of special test equip- ment on the prototype fuel control test bench. Bonch is roady for final checkout.	80	ENGINE CERTIFICATION Reference ongine network 1.06 for description and criteria.
11	COMPLETE TEST EQUIPMENT FOR PROTOTYPE CONTROL TEST SENCE Complete checked of toet equipment during finei chethapt of test banch. Operate fuel control.		
72	START MYBRAULIC FUND THE BENCH Initials design and procurement of the necessary associal test equipment for a protetype hydroulic pump test beach. Besign and procurement are in progress.		

iTIGH sciel test a environmental final checkout. ITION SYSTEM ment during final p ignition system.

ENCHES
of the necessary
slectronic fuel
nd procurement

ATION ecial test trol test final checkout. CTRONIC CONTROL

STAND (WILLGOOS of the necestary .0 altitude test .y. Design and

ATION secial test equip-med. Test stand

110 STAND (VILLOCOS pment during finel to ongino.

FD 17920 VH



1.06 ENGINE TEST - GROUND

The JTF17 engine will be developed to meet all the requirements of the engine model specification, recognizing the FAA's objective of obtaining a 600-hour minimum TBO for initial aircraft service with escalation of this overhaul interval to at least 3000 hours. It is the intent of the engine development program first, to demonstrate the specification performance levels; and second, by means of limits, overstress and endurance tests, to ferret out engine weaknesses and to force the appearance of failures during the ground test development cycle prior to the flight program.

This engineering development test program is designed to obtain the maximum amount of meaningful information in the shortest possible time. Design changes dictated by test results can thus be translated quickly into hardware, improvements can be verified by further testing, and product maturity can be achieved in minimum time.

The test goal for the development of the JTF17 engine in Phase III is the completion of the Flight Test Status Test in June 1969, and in Phase IV the completion of the Engine Certification Test in December 1971. Toward these goals it is ancitipated that the following approximate hours of engine and component rig test time will have been accumulated:

	Hours at FTS	Hours at End of Phase III	Hours at Engine Certification
Engine	4,000	8,000	14,500
Fan and Compressor	2,920	4,300	5,500
Primary Combustor	4,700	6,900	9,250
Turbine	2,540	3,290	3,750
Augmentor	2,460	3,220	3,970
Exhaust System	3,150	4,600	6,150
Controls and Accessories	46,000	90,000	137,000
Lubricants, Lubrication System, Bearings, Seals, and Gears	41,150	54,500	58,450

Statistical methods will be applied during the pretest planning to assist in the test integration. Component and engine test programs are devised to obtain the maximum relevant information from each test by (1) proper design of experiments, (2) analysis of instrumentation precision and accuracy, (3) statistical data analysis, and (4) the measurement of the uncertainty associated with the estimates and conclusions based on experimental data. Statistical methods will also be used in optimizing computer data reduction programs, determining instrumentation requirements and calibration methods, and in the analysis of reliability data.

PWA FP 66-100 Volume V

Initial engine testing in Phase III will be conducted utilizing the three JTF17A-20 engines available from Phase II-C. These engines will be supplemented by additional development engines that have been fabricated to the JTF17 parts list resulting from the Phase II-C effort. The three engines completed in Phase II-C will be refurbished to the later design during Phase III. Approximately 12 JTF17 development engines will be active in the program through engine FTS and 15 engines through Certification. It is expected that approximately 4000 hours will have been accumulated by FTS and 14,500 hours by Engine Certification.

The component and engine test programs are closely interrelated. It is the purpose of the engine test program to continue the development of the components as an integrated part of the engine systems. Complete component interaction cannot be adequately simulated in the component test rigs.

Engine testing will be conducted at sea level conditions with and without heated inlet and also at simulated altitude conditions.

A. Engine Calibration

1. Sea Level Calibration

Sea level calibrations will be accomplished to determine engine and component performance. Pertinent parameters will be recorded to measure the integrated system performance; i.e., airflow, fuel flow, thrust, inlet and discharge pressure and temperature of the fan and high compressor, main burner pressure drop, turbine discharge pressure and temperature, duct heater inlet and discharge pressure and temperature, and reverser-suppressor discharge pressure and temperature. Calibrations will be completed with and without the reverser-suppressor installed on the engine.

Design modifications will be accomplished as dictated by test results. These modifications will be incorporated into the engine and additional calibrations will be completed.

2. Altitude Calibrations

Altitude calibrations to determine performance will be conducted under simulated transonic, subsonic, and cruise conditions except as limited by the facilities utilized. The same types of parameters as described in (1) preceding, will be recorded. As in the case of the sea level calibrations, design changes in the engine will be evaluated where they affect performance.

Types of Calibrations

a. Starting

Sea level starting calibrations will be accomplished to establish and develop the engine start cycle. Such variables as ignition, speed fuel flow, etc., will be measured.

PWA FP 66-100 Volume V

b. Windmill

The engine windmill airflow will be measured over a range of altitude and Mach numbers to determine windmilling drag.

c. Altitude Relight

Primary combustor and duct heater relight capability will be developed to meet the requirements of the engine model specification, and the relight margin will be established.

d. Performance

Sea level and altitude calibrations will be accomplished to establish and develop the required level of performance of the complete engine as well as component interrelated performance.

B. Reliability and Durability

1. Endurance

An intensive endurance program which includes limits and weak link testing to uncover engine deficiencies will be completed under both sea level and altitude conditions to develop and establish the durability and reliability of the JTF17 engine system and the reverser-suppressor. The initial phase of this program will be accomplished at sea level conditions and, as soon as adequate capability has been demonstrated, the program will be extended to the altitude phase to test the engine at subsonic, transonic, and cruise conditions. A major portion of this testing will be conducted in the form of a typical mission cycle, as defined by the engine model specification.

2. Vibration and Stress

Sea level and altitude engine tests will be accomplished to measure and reduce to acceptable levels the operational engine system vibration and stress levels of all major rotating and stationary components such as blades, disks, shafts, front and rear engine mounts, compressor and turbine stators, etc., during steady-state and transient sea level, subsonic, transonic, and cruise conditions. Critical speed calculations will be verified by this testing and monitoring points for future Aircraft Integrated Data Systems will be established, in part, by this testing through the establishment and monitoring of linear vibration pickup points.

3. Heat Rejection

Engine fuel and oil system heat rejection characteristics will be established and developed to the level required for satisfactory engine operation. This development will be conducted at both sea level and altitude and at all engine operating conditions. In addition, engine case heat rejection levels will be established for conditions through the engine operating envelope.

PWA FP 66-100 Volume V

4. Ingestion Tests

Ice and birds will be introduced into the engine inlet with the engine operating at various engine power settings and at various subsonic speeds.

5. Fatigue Life Tests

a. Low Cycle Fatigue (LCF)

Engine cyclic testing will be conducted to supplement laboratory material and spin pit tests to develop and demonstrate adequate LCF of all compressor and turbine disks. Each LCF test cycle will consist of a simulated climb to cruise Mach number from sea level takeoff and return. Cycling will be conducted at the rate of temperature changes anticipated for aircraft service. These cycles will be accomplished in a sea level test stand utilizing heated inlet air. Intermediate inspections will be made to record pertinent data such as disk and blade growth and parts distortion.

b. Thermal Fatigue

The development of adequate thermal fatigue life capability will be accomplished through cyclic engine tests consisting of accelerations from idle conditions to maximum turbine inlet temperature and return. It is the goal of this program to demonstrate total system integrity for 1000 cycles.

6. Thermal Gradient Tests

These tests will be conducted at both sea level and altitude conditions to obtain steady-state and transient temperature data of critical rotating and stationary parts to develop and demonstrate satisfactory thermal gradients. Of particular interest are bore to rim disk, and turbine blade and vane radial and chordwise gradient characteristics.

7. Noise Level

Calibrations of the complete engine with the reverser-suppressor installed will be obtained to establish the perceived noise levels at various engine power settings up to sea level takeoff conditions. Measurements will be made of both near and far field noise. Analysis will be made of the data from these tests, and design modifications will be accomplished and evaluated. Variations of the quantity of secondary and tertiary air supplied to the reverser-suppressor are typical of some of the modifications that may be tested. Duct sound attenuation schemes such as acoustic liners, will also be investigated, if required.

8. Containment

During the course of engine testing at overspeed, overtemperature, and high vibratory and stress level conditions some failures of engine parts will undoubtedly occur and the ability of the engine to contain such failures will be demonstrated. In addition to engine testing, failures

PWA FP 66-100 Volume V

that occur in compressor and turbine rigs will also serve to demonstrate the ability of the engine to contain such failures. It is to be noted that these component test rigs utilize engine-type cases or the equivalent.

9. Failure Analysis

Engine testing at overload conditions will force failures of engine parts to occur. These failures will be analyzed and corrective action will be taken. Retesting of the redesigned components under those conditions which induced the original failure will be conducted to establish the validity of the corrective action. This work will be supplemented by laboratory testing of engine materials and structural parts under simulated loads. Stress coating and strain gages will be used in this test effort.

10. Simulated Flight Maneuver Loads

Static frame testing under simulated manuever load conditions will be conducted on all major structural cases. These tests are accomplished by applying the loads encountered under flight maneuver conditions to a static frame consisting of the engine structural load carrying cases. Stress-coat material will be used to define the high stress areas, and the subsequent reapplication of the simulated flight maneuver loads with the strain gages located at the high stress areas will enable accurate determination of the stress level of the part. Corrective redesign action will be taken, as required, and the parts will be subsequently retested.

ll. High "Q" Test

Engine tests will be conducted at engine operating conditions simulating the range of high "Q" conditions to be encountered in service use to demonstrate the engine structural reliability. These tests will also serve to further demonstrate the durability and reliability of the thrust bearings.

12. Control System

Engine tests directed toward development of the control system will be conducted at both sea level and altitude conditions. These tests will include evaluation and development at transient as well as steady-state operation of items such as throttle response, main and duct heater fuel flow metering, duct heater nozzle response rate, etc. Integrated engine system development of each of the control systems will be accomplished. This will include evaluation of the main fuel control, duct heater controls, bleed pilot valves, hydraulic system, etc.

13. Integrated Engine System Component Tests

The component test program includes performance and durability development at sea level and altitude conditions. Off-design and limits testing will be accomplished to determine component operation margins. These data will be used to assist the design effort involving corrective action or redesign and the establishment of service operation limits. In addition, the component programs will evaluate the effectiveness of service repair techniques and service repair limits. Extensive instrumentation will be used as required in the component rigs for the aforementioned programs.

PWA FP 66-100 Volume V

a. Fan and High Compressor

Engine testing at sea level and altitude steady-state and transient and at starting conditions will be conducted to determine and develop satisfactory operation of the fan and high compressor with respect to the following:

- 1. Stress levels
- 2. Performance
- 3. Surge characteristics
- 4. Distortion tolerance
- 5. Flow split (duct flow vs high compressor flow)
- 6. Durability
- 7. Service repair limits.

b. Main Burner Test

Sea level and altitude tests will be conducted at transient and steadystate conditions to determine and develop satisfactory main burner performance characteristics in the following areas:

- 1. Pressure loss
- 2. Turbine inlet temperature pattern, radial and circumferential
- 3. Durability
- 4. Service limits
- 5. Repair limits
- 6. Fuel nozzle performance (carbon formation, correct spray pattern, etc.)
- 7. Relight capability.

c. Turbine Test

Engine testing will be conducted at sea level and altitude conditions under both steady-state and transient conditions to develop satisfactory operation of the turbine with respect to the following:

- 1. Performance
- 2. Durability of materials and coatings
- 3. Cooling effectiveness of aircooled stages
- 4. Thermal fatigue life
- 5. Overtemperature.

d. Duct Heater Test

Sea level and altitude tests will be accomplished at steady-state and transient conditions directed toward the satisfactory development of the following characteristics of the duct heater:

- 1. Durability and reliability
- 2. Performance
- 3. Relight capabilities and characteristics
- 4. Nozzle response rate
- 5. Radial and circumferential temperature distribution.

PWA FP 66-100 Volume V

e. Reverser-Suppressor Test

Engine testing will be conducted to develop the required capability of the reverser-suppressor with respect to the following:

- 1. Performance
- 2. Durability
- 3. Noise suppression
- 4. Reverse thrust capability.

14. Maintainability

The total maintainability concept designed into the engine will be demonstrated in the engine test program. Specific items that will be established are:

- The number of manhours to perform operations such as filter inspection, fuel control component replacement, hot section inspection, main burner liner inspection, duct heater inspection, high compressor inspection, reverser-suppressor removal, lst-stage turbine vane replacement, and turbine replacement
- Adequacy of the tools to accomplish the above mentioned tasks
- 3. Adequacy of techniques such as radioisotope and X-ray, for inspection of internal engine parts
- 4. Adequacy of the locations of inspection ports, borescope holes, tube connections, brackets, ground handling lugs, etc., to facilitate maintainability.

15. Flight Test Status Test (FTS)

The suitability of the engine for use in the prototype flight program will be demonstrated by the satisfactory completion of an FTS in June 1969, in accordance with the requirements of the 75-hour endurance test described in the JTF17 engine model specification. The official FTS test will be preceded by at least one unofficial endurance test to this schedule.

PWA FP 66-10¹ Volume V

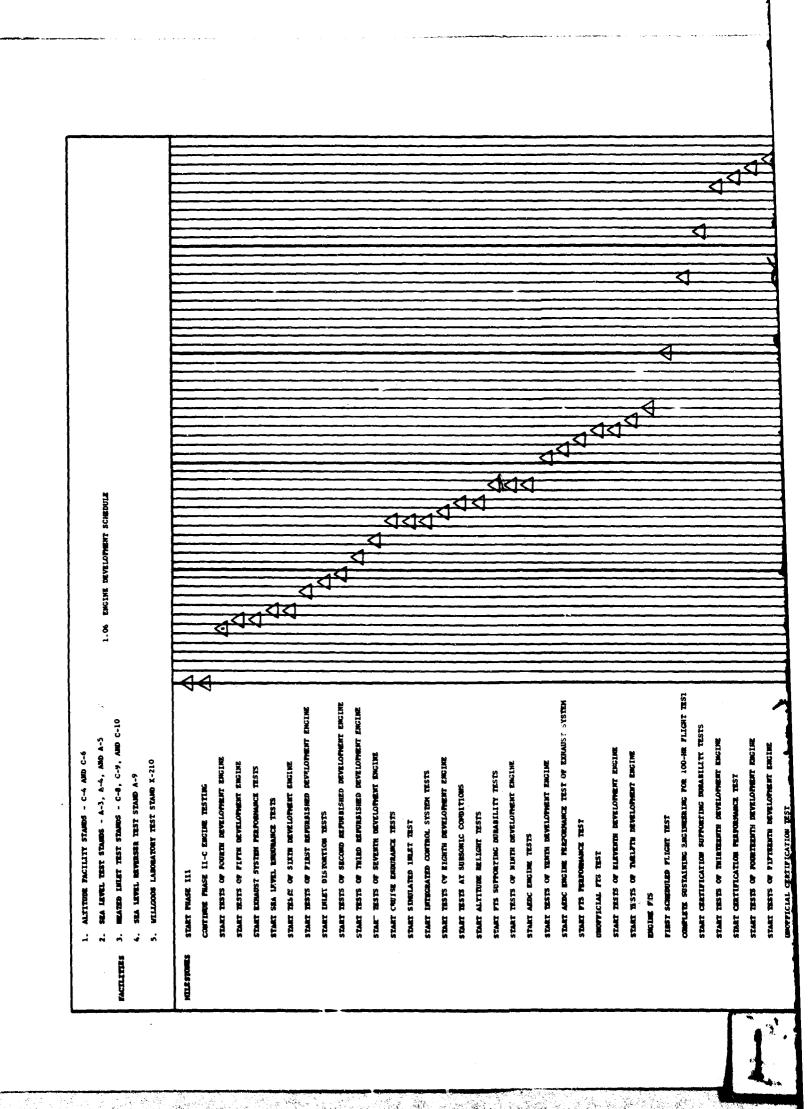
16. Engine Certification Test

During Phase IV the official engine certification test, in accordance with the schedule defined by the engine model specification, will be completed on December 1, 1971. The official test will be preceded by at least one unofficial test. This test and the supporting data for certification will encompass the following:

- 1. 150-hour endurance test at simulated aircraft mission conditions
- 2. Maximum low and high rotor speed test
- 3. Starting
- 4. Maximum exhaust gas temperature tests
- 5. Maximum oil temperature tests
- 6. Engine component bench and environment tests
- 7. Oil tank tests
- 8. Foreign object ingestion
- 9. Demonstration of LCF characteristics
- 10. Surge characteristics
- 11. Fuel system icing tests
- 12. Induction system icing tests
- 13. Failure analysis of control system
- 14. Turbine rotor overspeed test and measurement of disk and blade stress in engine and/or rigs
- 15. Turbine overtemperature test and measurement of disk and blade stress in engine and/or rigs
- 16. Thrust response
- 17. Gearbox substantiation 150-hour endurance test at rated torque
- 18. Calibrations performance demonstrated before and after the endurance test.

The major milestones, network chart and event dictionary for engine testing are shown in figures 11 and 12, respectively.

A detailed description of the engine test program is presented in the Test and Certification Plan, Volume III, Report E, and testing planning and integration is presented in Test, Volume IV, Report E.



PWA FP 66-100 Volume V

FD 17864 VH

1971 1920 SPINAMUSE COMPSENAMUSE ASSOCIATION SPINAMUSES OF B 1969 ব্যব্যব COMPLETE SUSTAINING ENCINEERING FOR 100-HR PLICHT TEST START ARDC ENGINE PERPONANCE TEST OF EXHAUST SYSTEM

START CERTIFICATION SUPPORTING MMABILITY TESTS START TESTS OF TRIBUTALISM MEVELLOPAGNE ENGINE

FIRST SCHEMENTS FLICHT TEST

START TESTS OF KLEVENTH DEVELOPMENT ENGINE START ILSTS OF THEIFTH DEVELOPMENT ENGINE

START TESTS OF TENTA BEVELOPMENT ENCINE

START PTS PREPORMANCE TEST

MOPFICIAL PTS TEST

START TESTS OF HINTH DEVELOPMENT ENGINE START PTS SUPPORTURE DURABILITY TESTS

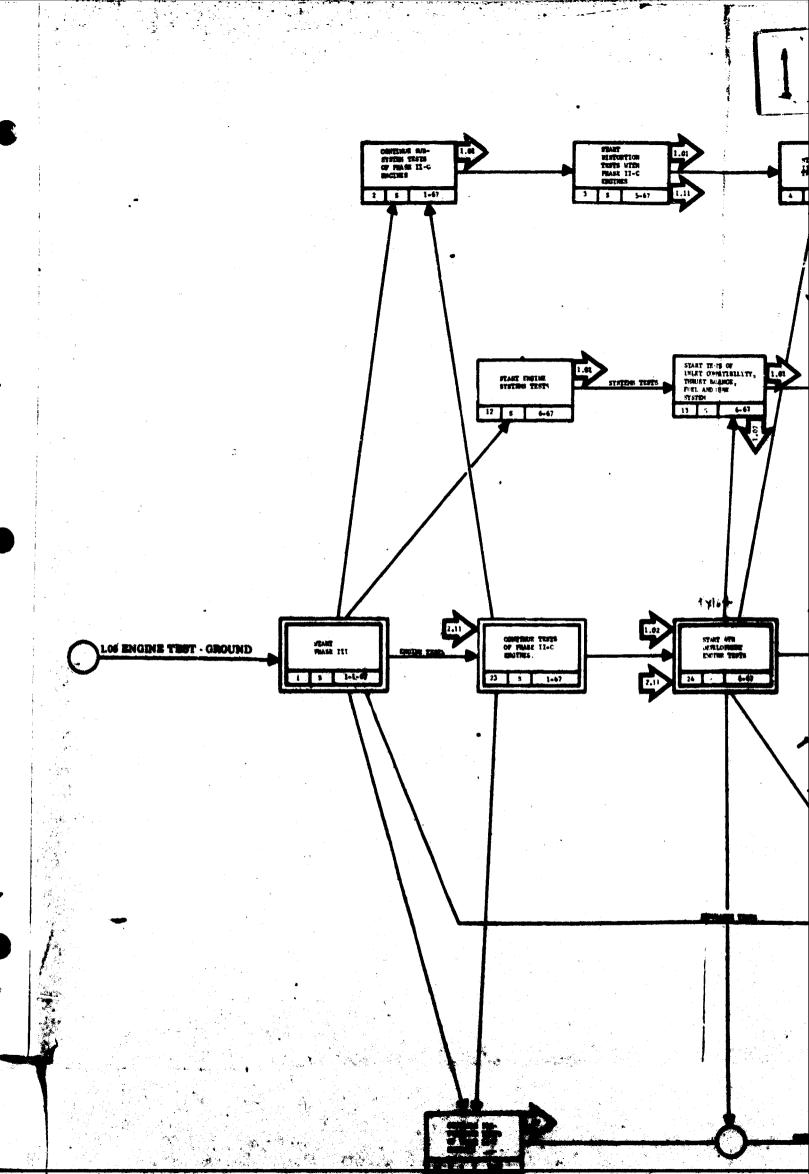
START ARDC ENGINE TESTS

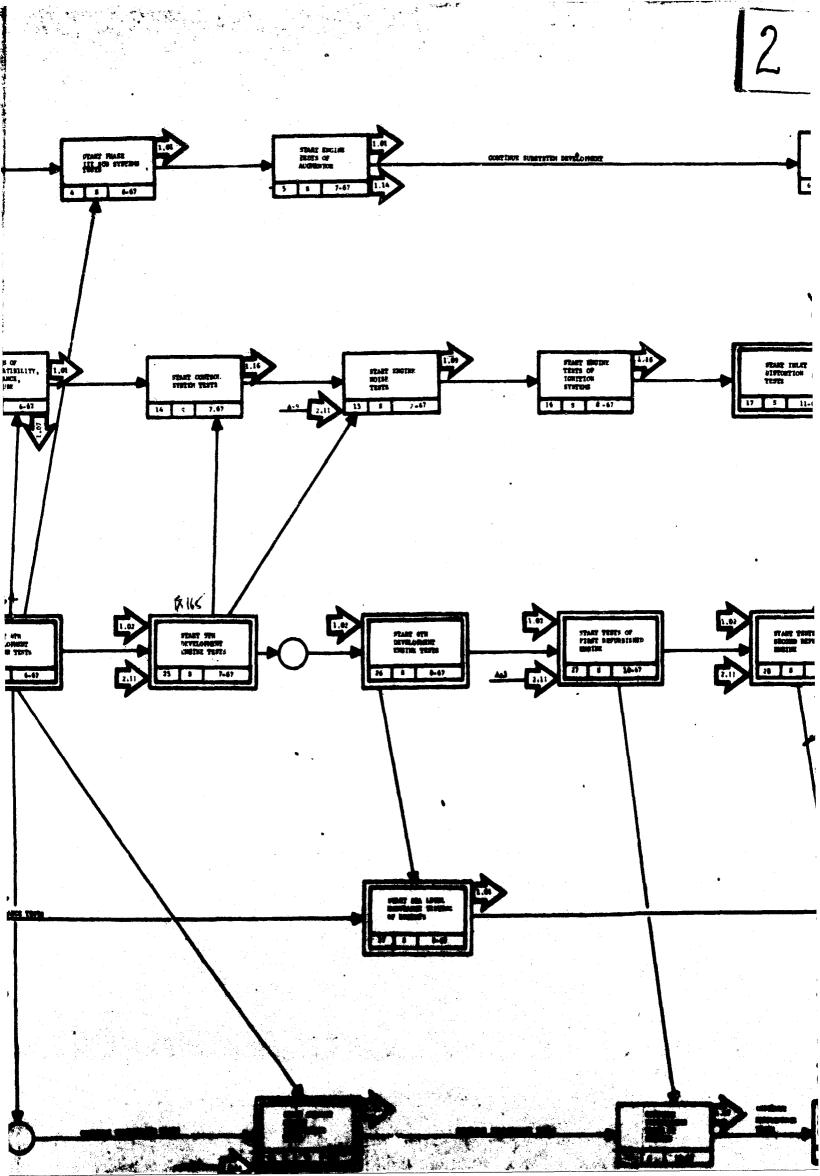
START TESTS OF PIPTERNTH PEVELOPHENT ENCINE

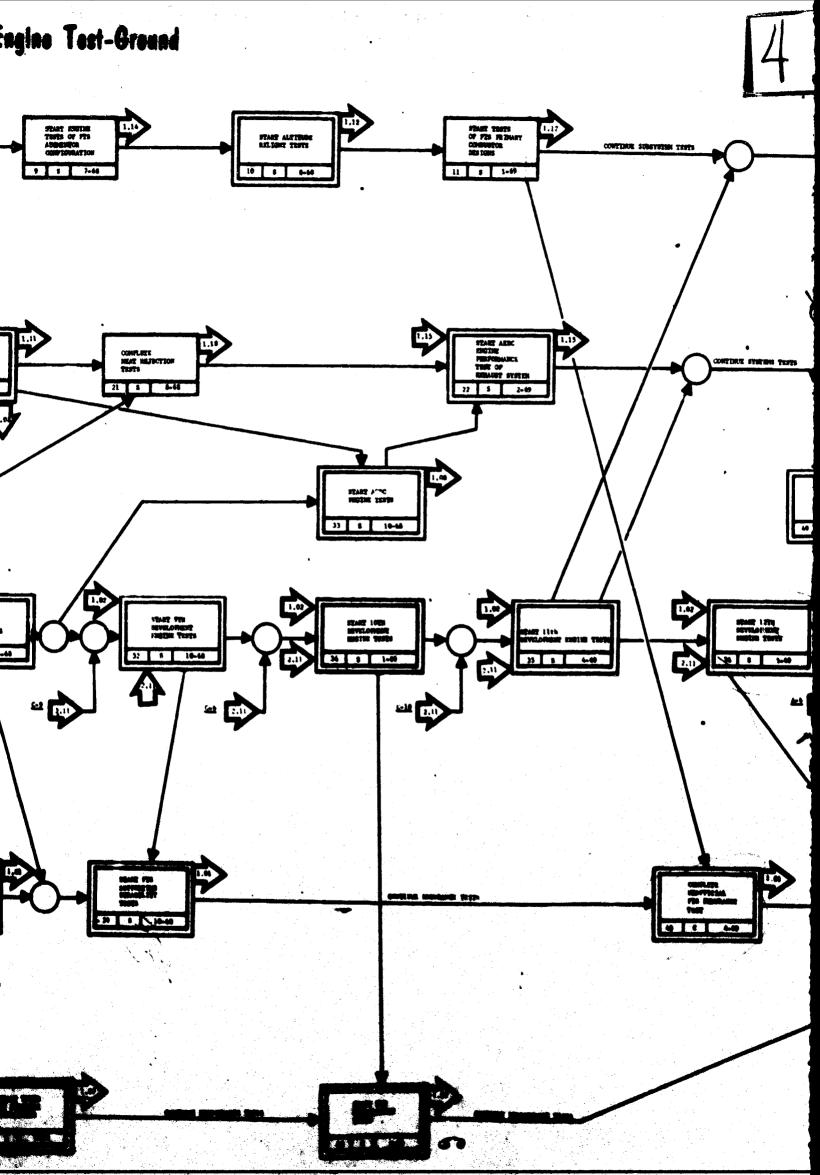
HOPFICIAL CERTIFICATION 1851

DICTING CRITIFICATION

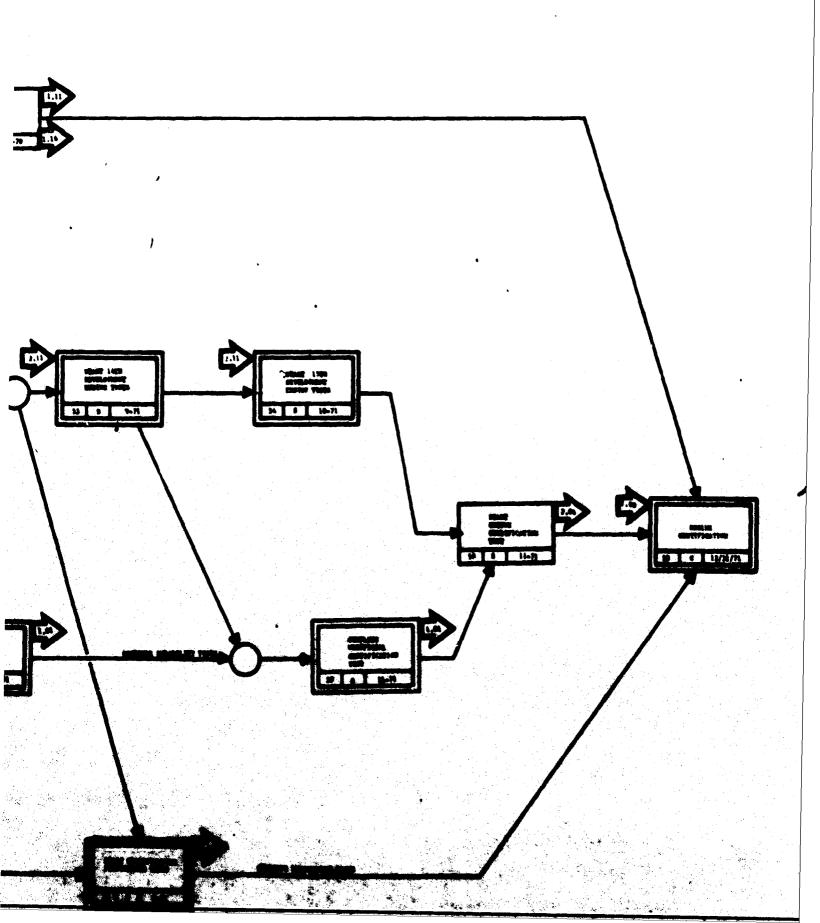
START CERTIFICATION PURPORMANCE TEST START TESTS OF POURTSKIND DEVELOR Pigure 11. 1.06 Engine Test - Ground

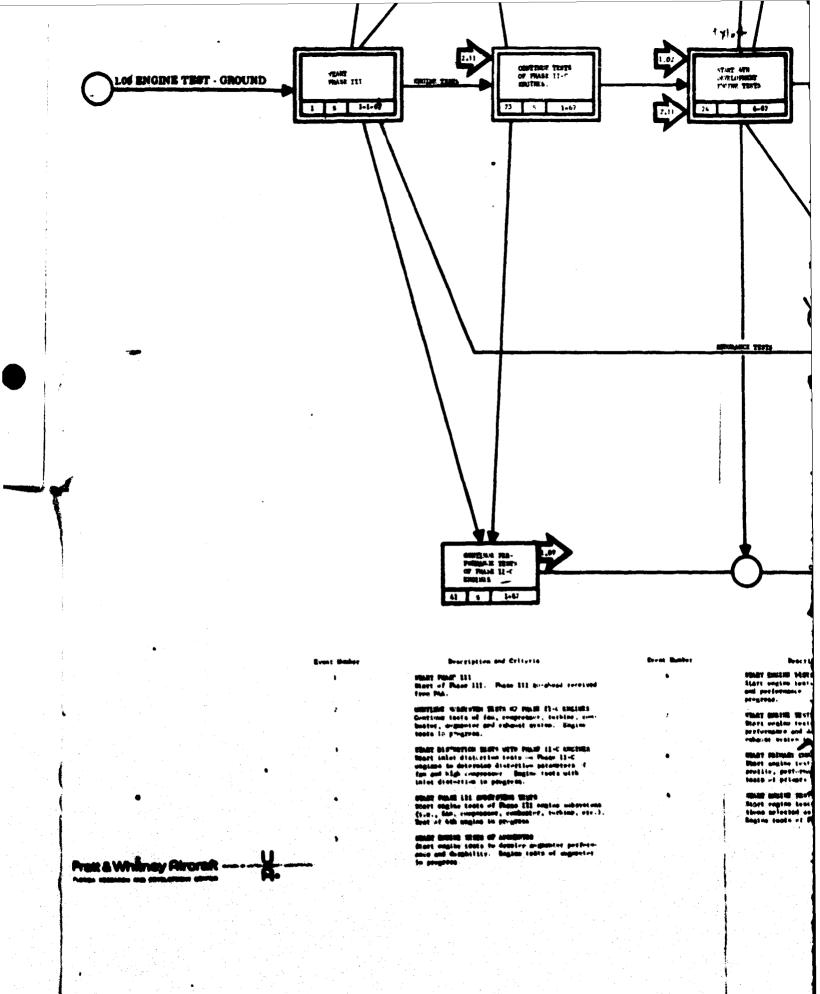


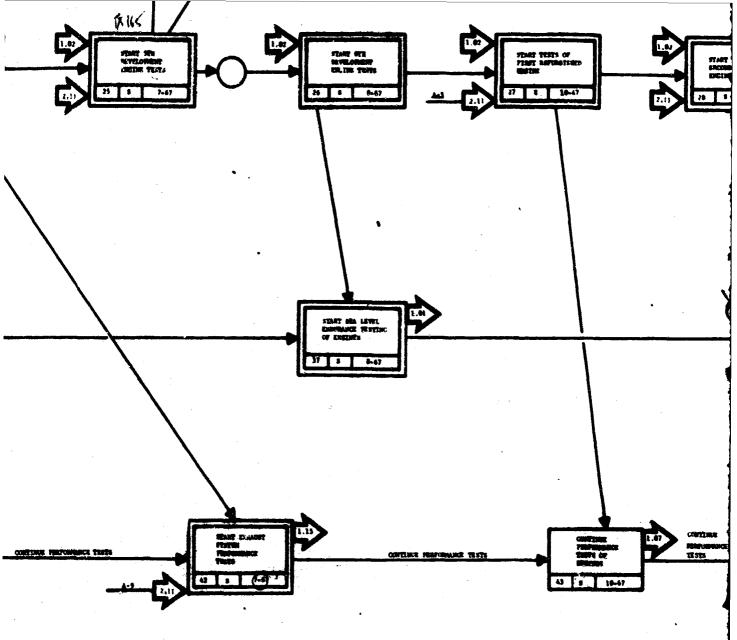




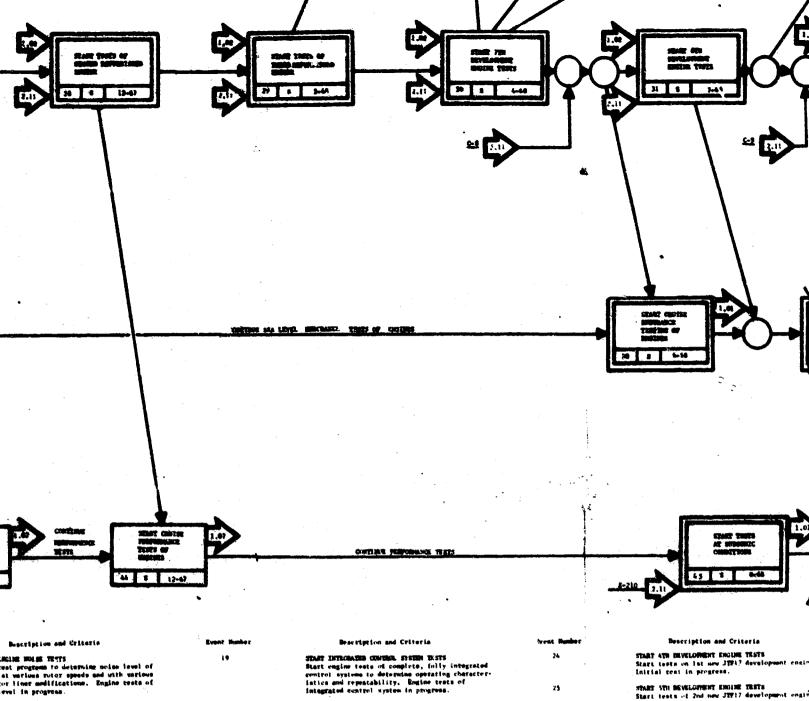
Figurel2.







CONSTRUCT MEASURE LINES	— of 100	CONTENER HEAPTHWARE TESTS		12518 TESTS
	al-I	<u>ori</u>	ण	10-67
acription and Criteria	Event Beaher	Description and Criteria	Bross Sumber	Beautiption and Criters
Mérs of Tubbie lests to develop turbine durability le. Rogine tusts of turbine in	a LO	START ALTITUDE RELIGHT TREES Start relight calibrations of the JTF17 main combustor and dugmentor in FUNC altitude facility or Wiltgook Tubbies Laboratory. Regime tests of relight capabilities in progress	15	START ENGINE NORM TESTS Start test program to determine engine at various rutor speeds a sugmenter liner modifications. noise level in progress.
Ests of Building system ests to develop submist agains of deshiftly. Engine tests of a in progress.	•	START TERES OF FTS PRIMARY COMMISTOR DESIGNS Statt dopine tests of refined combustor con- cignrations selected for FTS engine. Engine tests of FTS consustor in progress.	16	Shart Engine Tests or Ignition a Start engine tests to determine teristics of refined ignition of Engine tests of ignition available
COMMISTOR EMILIAE TESTS cets to develop primary combinator creamus and durability. Esgins try combinator in progress.	17	START EMOLIS. SYSTEMS TESTS Start engine tests of major engine systems. Engine tests of major systems in progress.	17	START INCET DISTORTION WAYS Start took programs on engines tortion parameters of the San of Stading tests of inject disportion
MENTS OF PID INCREMENT OF TOWNSON LESSE OF TREINER BURGARNING SUNFAME. 1 on against the PTS organization. 1 PTS augmented in progress.	13	START Their OF INLE COMPATIBILITY, DON'ST BALANCE, FULL AND LUES STREET Start cogine rosts of major engine systems to determine operational characteristics, performance, and durability. Engine tests in progress.	18	START ENGINE TROPS OF ACCURTICAL Start test ; "grams on segimes of effects of acoustical liners in levels. Engine thate of acoust
	14	START CONTROL SYSTEM THEYS Start ong. w tests of engine control systems to determine performance, detablity and operating chapterestelses. Control system tests in progress.		progress.



Description and Criteria	Event Hunber	Beacription and Criteria	trest Humber
moint woigh TETTS	i9	START INTEGRASES CONTROL SYSTEM TESTS Start engine tests of complete, fully integrated control systems to determine operating character-	24
at various roter speeds and with various or liner modifications. Engine trats of evel in progress.		intica and repeatability. Engine tests of integrated control system in progress.	25
INCIDE TRATE OF LOUITION SYSTEM	20	START SDELATED CLEARING TRAFFIN	
maine tests to determine operating charac- ics of rafined ignition system designs. tests of ignition system in progress.		Start test programs with similated inject to determine compatibility of engine/injet mystem. Angine tests with similated injets in progress.	26
MET BISTORTION SERTS Lest programs on entities to determine dis- parameters of the fan ind high compressor, tests of inlet disportion in progress.	n	COMPLEME MEAT SELECTION TESTS Complete heat rejection tests on engines to detersine hearing compartment heat leads and conting requirements. Heat rejection data analysis completed.	37
MRINE TESTS OF ACCUSTIGAL LIMES Lest programs on sugines to determine of accustical limers in reducing Public Engine rosts of accustical liners in He.	22	START ABBC ENGINE MEAPINEMENCE TEST OF EXHAUST SYSTEM Start performance tests of engine exhaust system in ABBC in progress.	28
	. 25	CONTINUE TESTS OF PRANK II-G EMBINES Continue engine testing of Phase II-G engines during varly part of Phase III. Start engine costs after Phase III ps-shoot.	

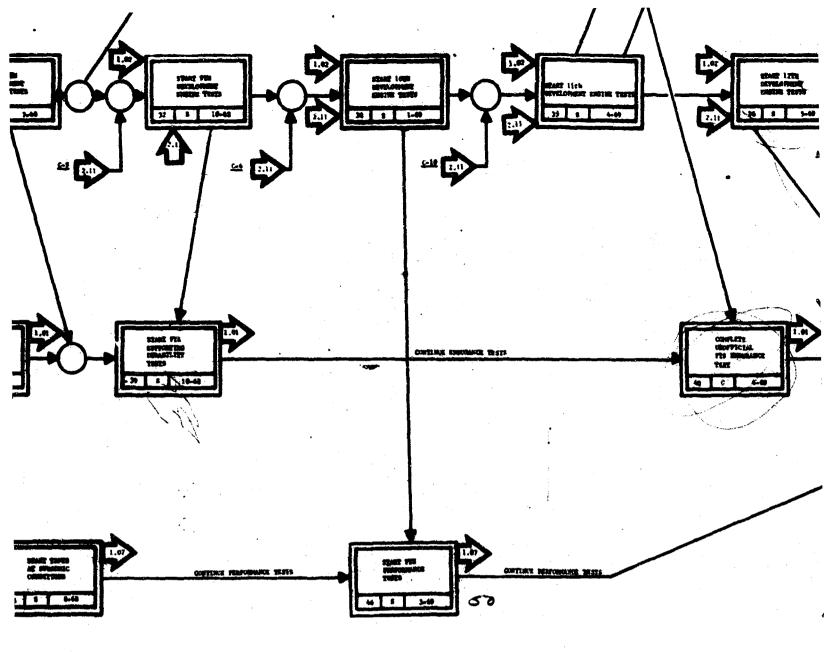
START 4TH BEVELORERY ENGINE TESTS Start tests on lat new JTP1? development enti-Initial test in progress.

STARE STH BEVELOPBENT ENGINE TREES Start tests of 2nd new JTF17 development engin Initial test in progress.

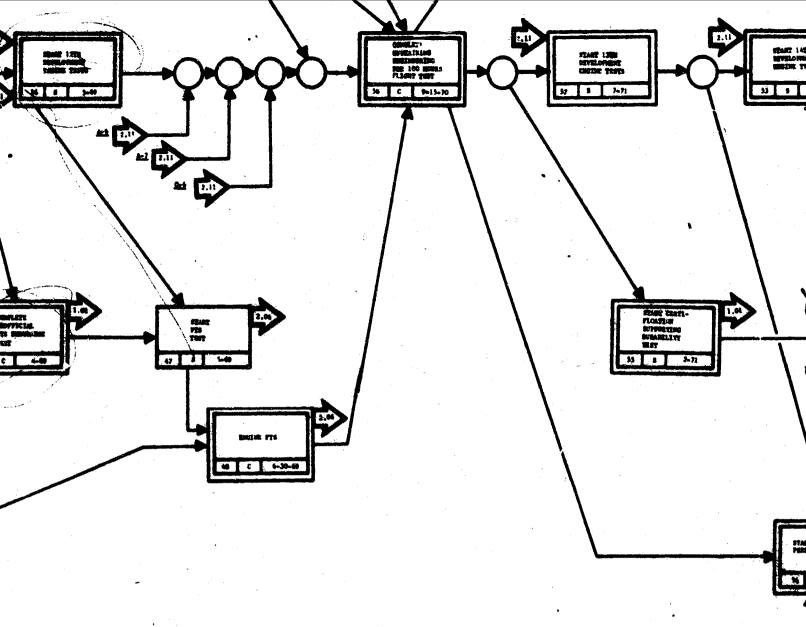
START OTH DEVELOPMENT ENGINE TRATS Start rests of 3rd new JTF17 development ongo Initial test in progress.

START TRATS OF LST REFURBLINGS TRICING Start tests on livet refurbished Phase 12-C engine converted to development configuration luttal test in progress.

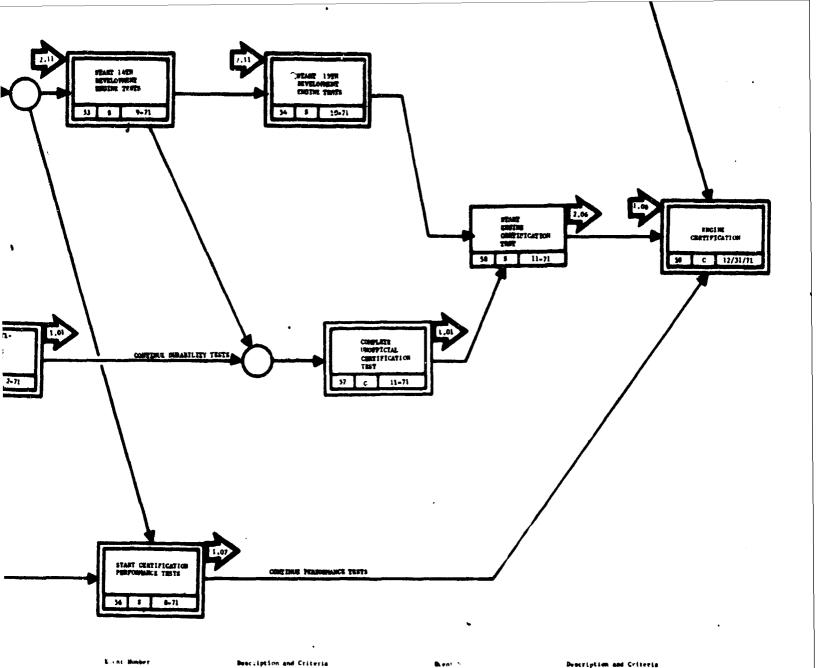
START TESTS OF 200 REPUBLISHED BROINE Start tests of 2nd returbished Phase II-C engine converted to development configuration initial test in progress.



len and Criteria	Ever Humber	Description and Criteria	Brent Huder	Description and Criteria
MENT ENGLISE TESTS t new JTP17 development ungine. tegress.	29	START TESTS OF THE SELFORSISHED EXCENT Start tests of 3rd refurbished Phase 12-6 engine converted to development configuration. Initial test in progress.	45	START LITH NEWSLOPMENT ENGINE TESTS Start Leate of 8th new JTF17 development engine. Initial test in progress.
Mint Shitim ISSTS is new JTT17 development sogime. Fugrass.	ĸ	STARY I'M SEVELOPERT ENGLISE TESTS Story tout of 4th new JET17 development ungine. Initial test in progress.	.	START 1278 DEVELOPMENT WALLE WATE Starts tests of 9th new JTF17 development engine. Initial test in progress,
MEMT ENGINE TESTS d new JTT17 devolopment engine. tograms.	11	STARY OTH DEVELOPMENT ENGINE TESTS Start tears of 5th new 1771? development engine. Initial test in progress.	37	START WAS LEVEL IMPURANCE TRATING OF ENGINES Start and level and remove testing of JTF17 development engines to evaluate durphility. Endurance testing in progress.
ragrobations Belling and control to development configuration configuration.	32 -	START THE BEVELOPMENT ENGINE TESTS Start Losts of Oth new JET? development engine. United test in progress.	• #	START CRUZES EMBROANCE TRETING OF MODIMES Start cruise endermice testing of JTF17 develop- ment engines to evaluate derability. Gruise endurance test is progress.
a appulationed and the discount of the discoun	, 39	START AND RIGHE TESTS THAT IN THE CONTROL OF	39	START PTS SUPPORTING BUBBBLITY TRATS Start durablity sesting on JTP17 development segious with refund PTS configuration sub-
	×	STARY LOTE DEVELOPMENT RECENT TRATES Start tests of 7th new JTP17 development sugine. Entitle test in progress.		systems. Burshilsty test in progress.



	•			•	
rta	Event Mumber	Bescription and Criteria	Svent Humber	Sescription and Gritaria	Burnt.
TROTS level opment angine.	46	COMPLETS UNCOYICIAL FTS MONTHANCE TEST Complete FTS endurance cycle test for FTS review. Somewe magine from test stand.	. 44	START CRUISE PERFORMANCE MISTS OF MIGHES Start engine performance tentà at arulae condi- tions to define performance parameters. Engine testo at cruise conditions in progress.	41
Mans development engine. The OF English	41	CONTINUE PRINTERNALS TESTS OF PMARE II-C ENGINES Continue performance trating of Phase EI-C engines to define cycle efficiency and performance parameters. Become c sting after Phase III goahaed.	43	START TESTS AT SUBSCRIC SOMETTICES Start tests of JTF17 engines at subscric condi- tions on E-210 Stand. Initial test on E-210 stand in progress.	. 50
ing JTP17 o oursbility. or MOIMES t of JTP17 develop-	42	START FYNAUST MYS. AN PERSONNANCE TESTS Start agine to at a constant explaint system morter maner and operational characteristics. Initial test of engine for embast system per- formance in progress.	44	START FTS PERFORMANCE TESTS Stort engine performance tests of JTT17 proto- type contine at operating points apocified in Mudel Specification. Performance tests in progress.	J
titty. Grains	43	CONTINUE PROFESSIONES WESTS OF ENGLISS CONTINUE performance testing of JTP17 development england. Busine performance tests in	47	START PTE TEST Start official PTE endurance test. First cycle of universe in progress.	12
TP17 development ignestion sub- progress.		progress.	49 .	EMEJME FTE G-uplets Einal acceptance trot fellowing a 75- hour endurance test on a JEP17 Parts List engine. Engine pursemeters must be within limits apositied in Mudel Specification during final acceptance test. ,	a n 1



				mages the same as seed to
INCINES : Dise condi-	4•	IST SCHEBULED PLIGHT WEST	*•	START 15TH DEVELOPMENT BUGINE THEFS
iers. Engine		Performint acheduled tlight test of airtrase/		Start toots of 12th new JTF17 development
reas,		engine proturype configuration, Complete first. Flight,		Initial test in progress
			15	START CERTIFICATION SUPPORTING BURABULTY
	10	CUMPLETE TESTALWING ENGENEERING FOR 100-HOUR		Start durability testing of certification
runti condi-		FLIGHT TEST		timurations in engines. Engine test of a
. on X-210		End of Phase III. Complete lift hours of flight		fication could prations in progress.
		testing.		
		***********	36	START CERTIFICATION PERFORMANCE SESTS
HT1/ proto	31	CONTLINIA SYSTEMS DEVELOPMENT		Start performance tents of JTF1 engine a
Kified in	•	Continue systems development for engine certi-		operating points defined to Medel Specifi
vete in		firstion configuration. System development in		forformance test in progress.
**** **				tottorium that to blodiese:
		programs after completion of 100 hours of filght texting.		COMPLETE CHAPPICIAL CONTIVICATION TEST
		citable tenting.	•	
First evels	12	P. 47 180 180 180 180 180 180 180 180 180 180 180 180 180 180 180 180 180		Complete moniticial cortification enduran
	••	START LITH DEVELOPMENT KINGENE TREES		on 17717 Parta List engine for certificat
		Start tents on 10th new JTF17 lew hipment engine. Initial tent in progress.		review. Because engine from test stand.
		THIS ARE THE BUILDING.	Va	STANT BRUINE CENTIFICATION TEST
iwing a 25-	1)	START 14TH MEVEL/MOUNT ENGINE PLETS	-	
a light engine.	••			Mart official cortification test. Pirst
mite specified		Mart tests on lith new JTF17 de giopmens ongine. Initial test in progress.		of unference in progress.
acceptance			59	ENLINE CHRESTIFICATION
				Complete final geceptance test following
				hour endurance trat on a JEST/ Parts List
				Engine parameters was he within limits w

Description and Criteria

TY TESTS ON COOK CVIII-

r at ification,

st eretr

662908 FD 17834



PWA FP 66-100 Volume V

1.07 ENGINE PERFORMANCE

Performance analysis of the JTF17 development engine will continue throughout Phase III and include data reduction, processing and analysis of all development engines and component rigs. Based on the results and the engine requirements, test programs will be designed to obtain the maximum relevant information from the minimum number of tests. Component performance analysis will be continued to ensure that the engine requirements for the component are reflected in the development program and to continuously rematch the development engines to take advantage of the latest component configuration. A digital computer simulation of the latest development engine configuration will be maintained.

Matching studies will be conducted to ensure that the engine configuration is based on the best use of its respective components. Special studies, such as tradeoffs for airbleed systems, power extraction, inlet-engine optimization emergency requirements, starting and heat rejection, will be continued to support the airframe manufacturer.

The analysis of noise, methods to attenuate noise, and methods to take advantage of the turbofan cycle to reduce noise will be continued throughout Phase III. Test programs will be designed to develop attenuation methods and to study the mechanism of noise generation within the engine. The water table will be used as a hydraulic analog for analysis of turbulent mixing regions as they relate to noise.

Steady-state digital computer simulations will be maintained and updated for the JTF17 production engine at Pratt & Whitney Aircraft, the airframe manufacturer and an agency designated by the Federal Aviation Agency. Transient simulation on analog, digital and hybrid analog-digital computers will be updated and provided to the same agencies. The transient simultations will include a dynamic representation of the inlet supplied by the airframe manufacturer.

Control analysis will continue and include the determination of control schedules; the dynamic analysis of the engine and control system; and the analysis of the interaction between the engine, control system, the inlet, and the inlet control system. This latter activity is part of the overall inlet-engine compatibility study which also includes the optimization of airflow relationships between the inlet and the engine and the effect of inlet generated distortion on the engine.

Statistical engineering is an integral part of performance and analysis, and particular emphasis will be placed on the following:

- 1. Planning and designing experimental programs
- 2. Instrumentation, precision and accuracy analysis
- 3. Selection and calibration methods for engine and component instrumentation
- 4. Analysis of experimental data including correlation regression and analysis of variance
- 5. Monte Carlo simulation for systems including stochastic elements

PWA FP 66-100 Volume V

- The assurance that correct inferences are made from experimental results
- 7. A measurement of the risk of error associated with conclusions and recommendations based on experimental results.

Final optimization of the engine will be based on analysis of the airplane mission including range, payload, economics, safety, noise and growth
potential. This activity requires the maintenance of airplane performance
digital simulation, extensive knowledge of various airline route structures
for the supersonic transport and the Federal Aviation Agency requirements
for airplane operation. Emergency conditions such as loss of cabin pressurization, engine failure, and diversion to alternate airports are included
in these studies.

The major milestones, network chart and event dictionary for engine performance are shown in figures 13 and 14, respectively.

A detailed description of engine performance is presented in Volume III, Report A, and test planning and integration is presented in Test, Volume IV, Report E.

PWA FP 66-100 Volume V

> FD 17865 VH

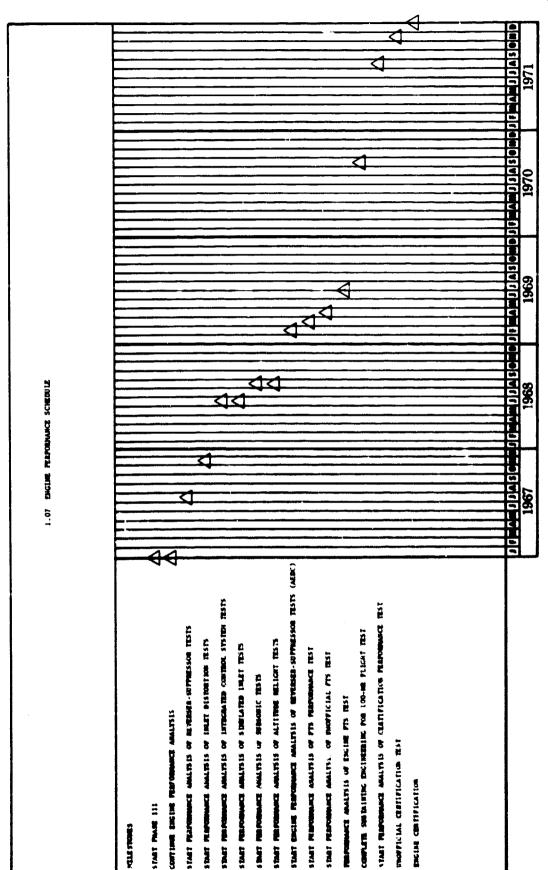
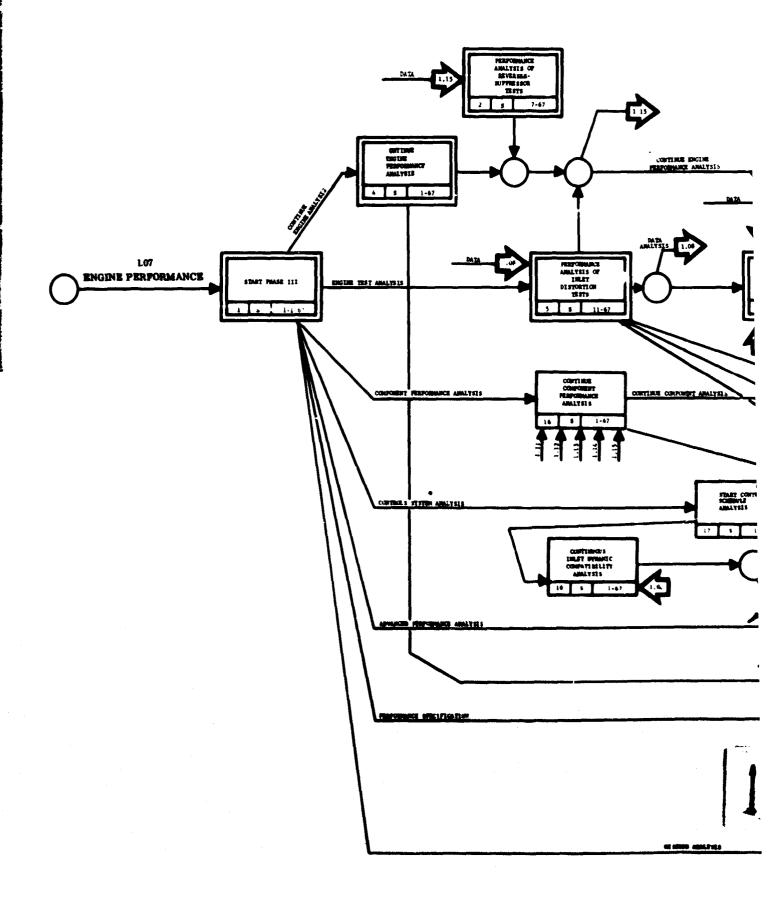


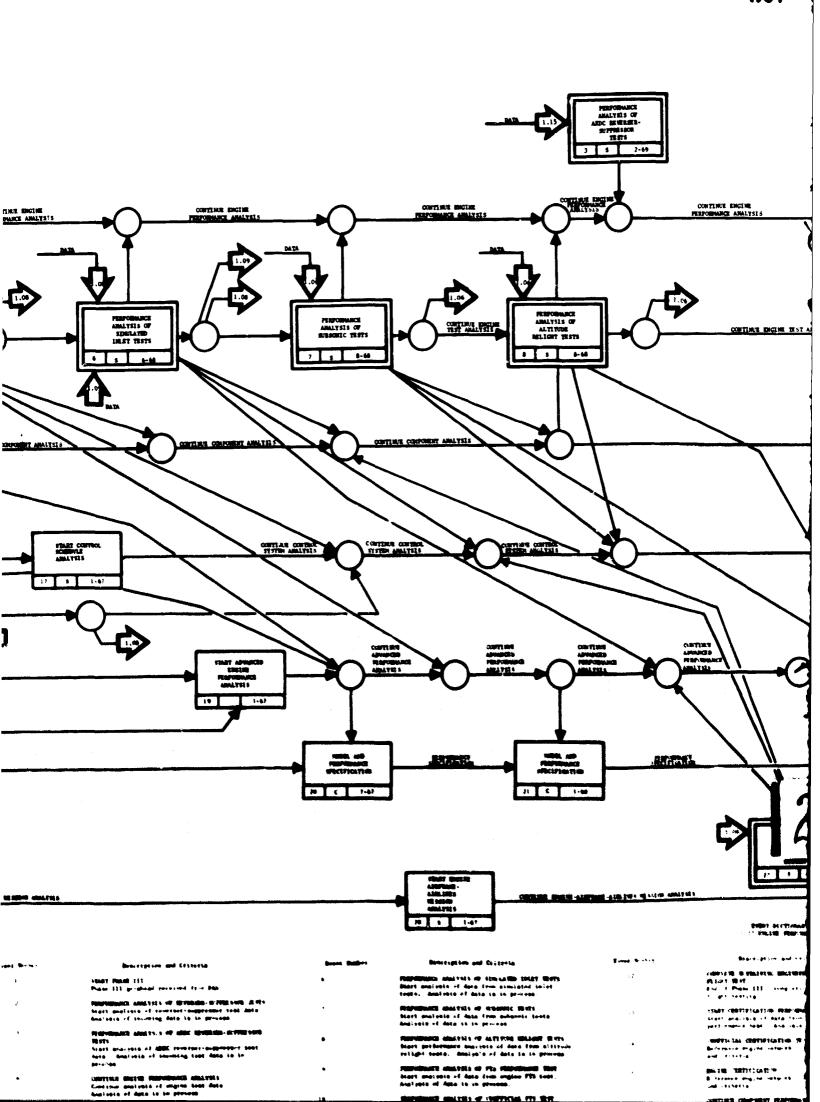
Figure 13. 1.07 Engine Performance



Ergel Brette

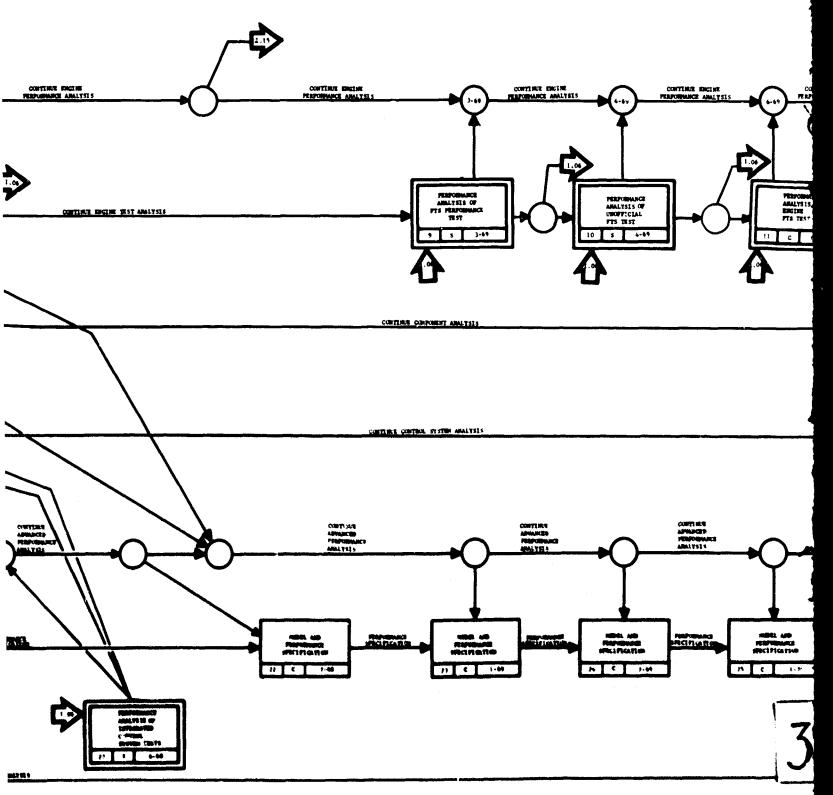
Pin Pin Pin 112 And PAS Sta deli ptin Comm

SECTION OF PERSON STATES



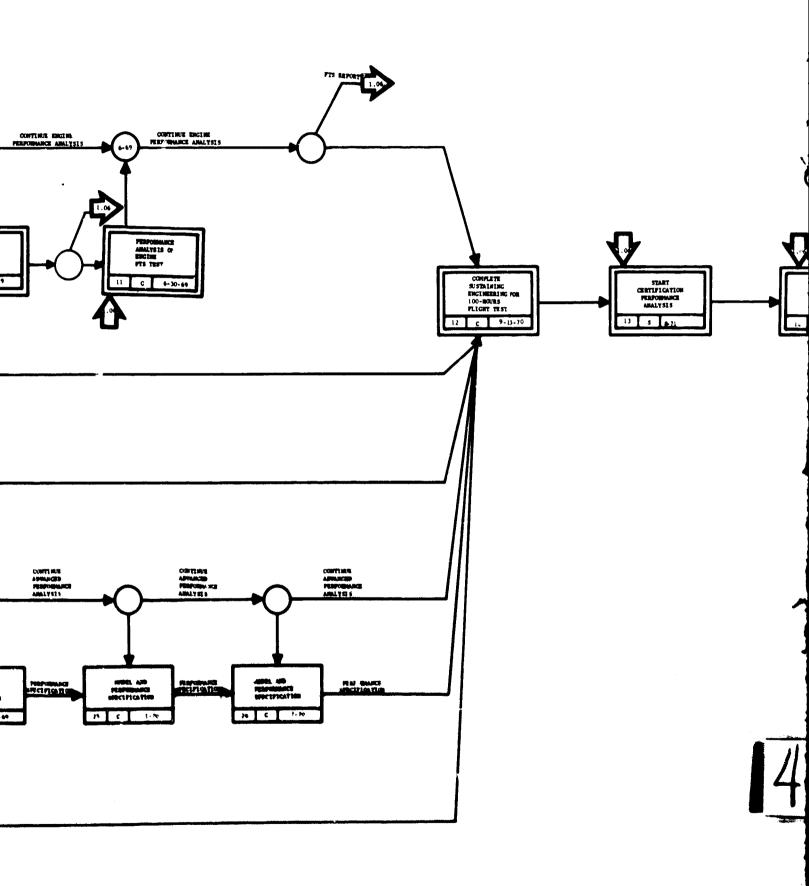
COUNTY OF THE PARTY OF THE

1.07 Engine Performance



BORN DECTABLES

Beartration and Consuma	Linet Capter	briefly ton and Cettoria	Frant Barber	Code tips son and Courses
company of statement discussions on the loss on the Palacet distribution of the statement o	; 8	contribute toler symmet convertally approves been received and received to the symmetry approves to the second symmetry approves	•	MINES AND PROFESSIONAL INSCRIPTIONS COMPLETE SPACE OF STREET AND STREET SPACE OF STREET SPACE SPACE SPACE OF STREET SPACE SPAC
symbol compression suppressions apparets that the services of data from Constitutions of an apparet process of data for an apparet participation and the services of data for an apparet participation of data for an appare	3.●	Place area of a property of the particle of th	n	commanded interferomental transformation communities and or original models professional appropriation to the community of th
remove has control and the first department of the fir	*	mings and minimum electrication Complete update of ampide model and performance approfitediane. Some prolaminary apportizations	26	mills and statements vinciples to Complete applies of engine made partirings operational table flow apprilings in
SMCCASS (SOUTHER THAN STANDARD AND AND AND AND AND AND AND AND AND AN	24	MRSS and Propriesure selectrication Complete update of engine codes and perfections openification. Tomo proliminals against addition.	**	State and rate of hote this between the
Continue consenses seasons tops destrict	<i>11</i>	United and Statements employees and perfections Complete updo a of engine and and perfections Mac(fination laws and belong any desired as	*	species from Anni pore of Ages in to proce



Bedertigeten und frageria

maks and Parameters wherestation Conductor collects of ongles makes perfectioned openification. Issue prolinteder apacification

WHELL CON HERMERANCE SPECIFICATION Complete l'Hade et emples andel prefermance april firetion. Louis prelitations aprilitation

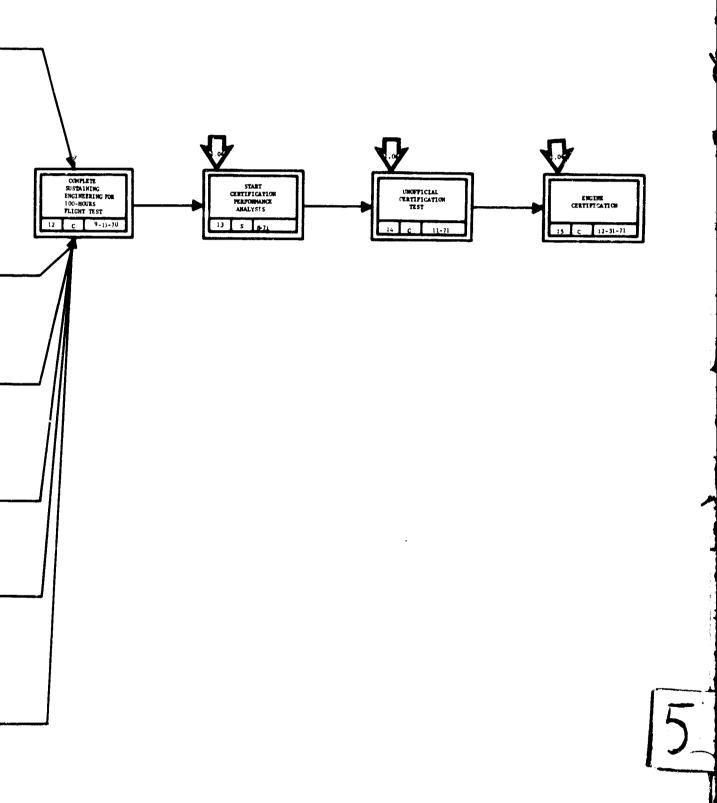
MARKE AND PARPHRANCE ARECTFICATION Complete sphate of angles model performance agentification. Labor fire aperification

REPUBLIES ABALTOLO OF LEGISLATED CITYERS.
CHANGE MATE .

CHANGE MATERIAL OF SEEL FROM LANGUAGEST CONTROL

CHANGE LOSSO STRUCTURE 15 SEEL TO SE

THE SELECT CONTRACT CONTRACT SERVICE CONTRACT SERVICES



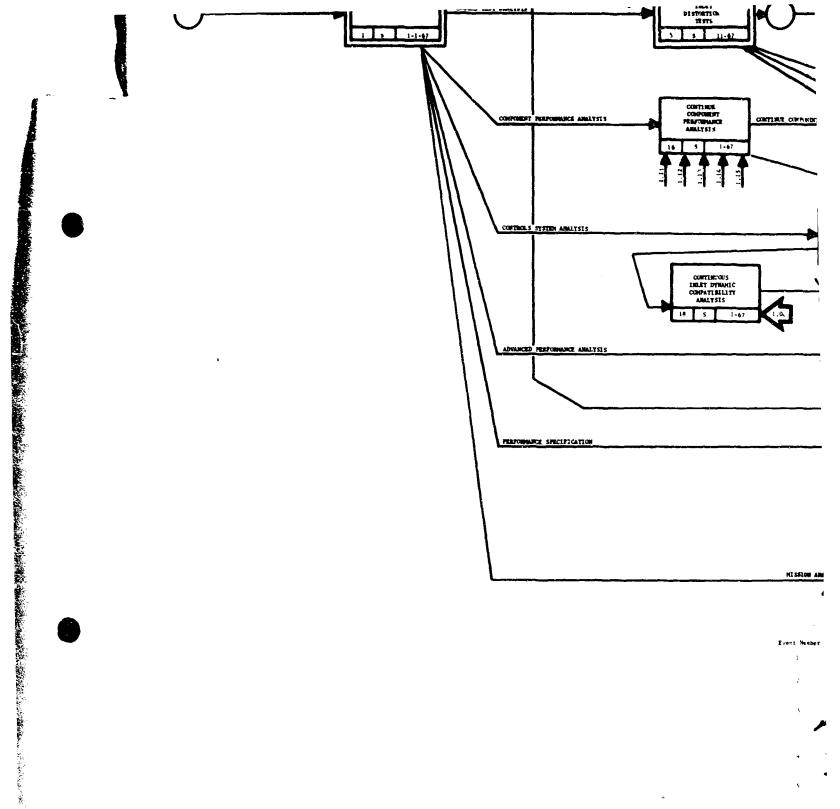
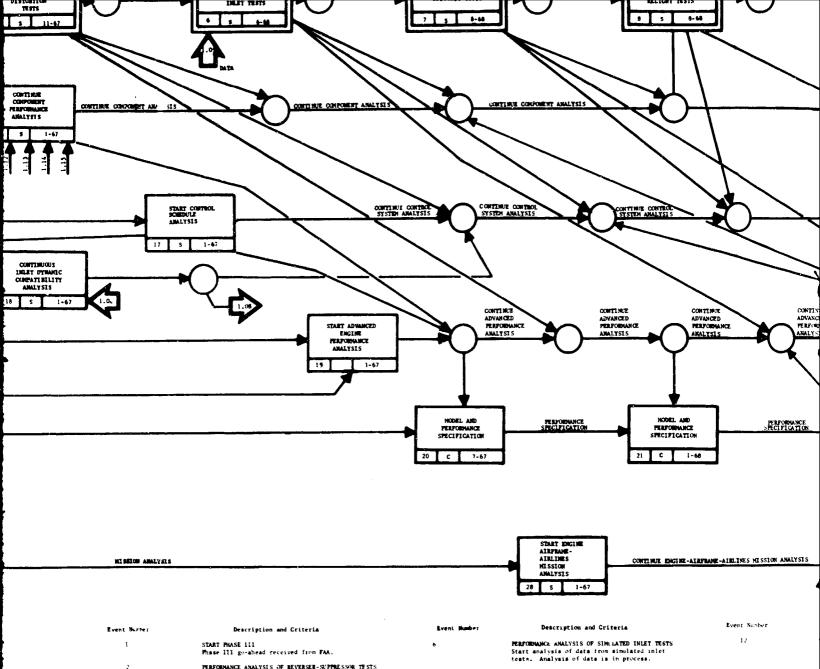
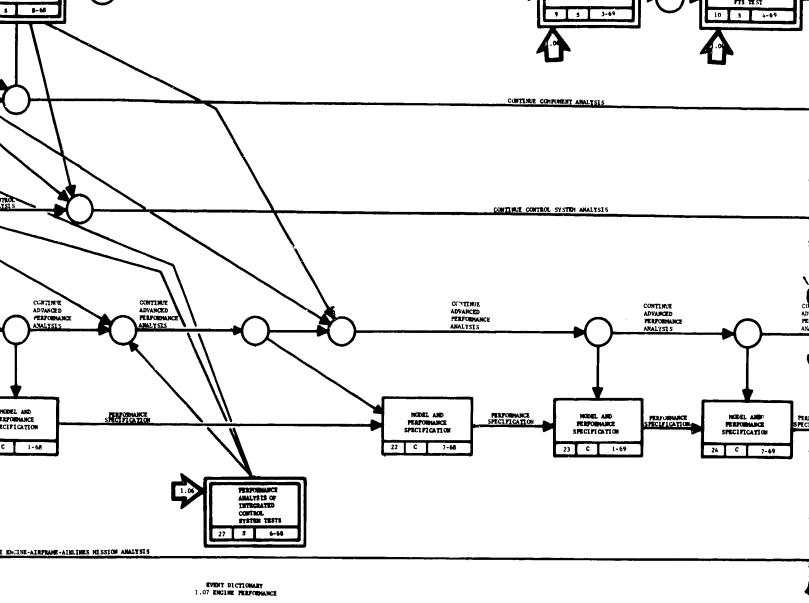


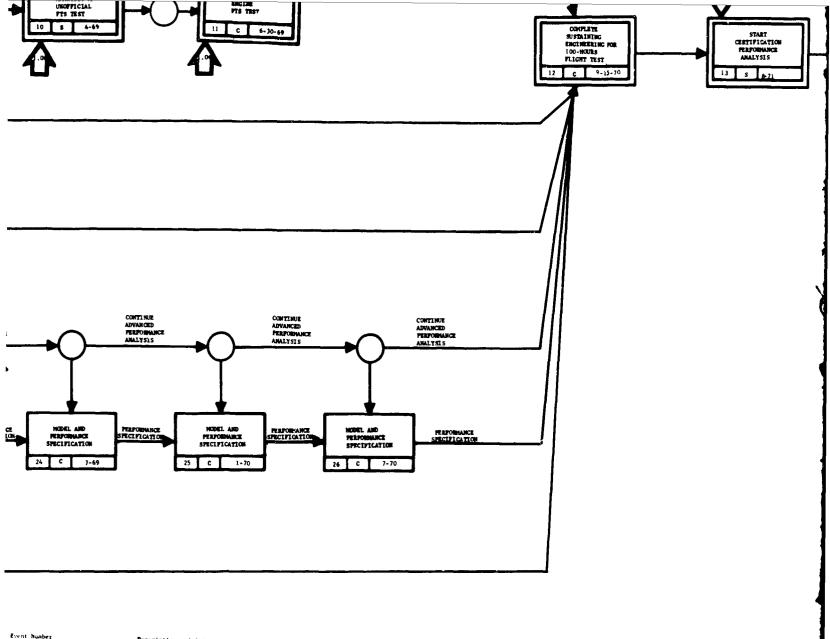
Figure 14. 1.07 Engine Performance



vent Nurber	Description and Criteria	Event Humber	Description and Criteria	2000
1	START PHASE III	6	PERFORMANCE ANALYSIS OF SIMILATED INLET TESTS	12
	Phase III go-shead received from FAA.		Start analysis of data from simulated inlet	
			tests. Analysis of data is in process.	
2	PERFORMANCE ANALYSIS OF REVERSER-SUPPRESSOR TESTS			
-	Start analysis of reverser-suppressor test data.	7	PERFORMANCE ANALYSIS OF SUBSONIC TESTS	
	Analysis of incoming data is in process.		Start analysis of data from subsonic tests.	13
	manyare to metalik and to provide		Analysis of data is in process.	
3	PERFORMANCE ANALYSIS OF AEDC REVENSER-SUPPRESSOR		•	
	TESTS	8	PERFORMANCE ANALYSIS OF ALTITUDE RELIGHT TESTS	
	Start analysis of AEDC reverser-suppressor test	-	Start performance analysis of data from altitude	i.e
	data. Analysis of incoming test data is in		relight tests. Analysis of data is in process.	
	process.			
	P	ų	PERFORMANCE ANALYSIS OF FTS PERFORMANCE TEST	
4	CONTINUE ENGINE PERFORMANCE ANALYSIS		Start analysis of data from engine FTS test.	1.5
	Continue analysis of engine test data.		Analysis of data is in process.	
	Analysis of data is in process.		•	
	in and the second secon	10	PERFORMANCE ANALYSIS OF UNOFFICIAL FTS TEST	
5	PERFORMANCE ANALYSIS OF INLET DISTORTION TESTS		Start analysis of data from unofficial PTS test.	· 6
•	Start analysis of inlet distortion test data.		Analysis of data is in process.	
	Analysis of data is in process.		•	
	n	11	PERFORMANCE ANALYSIS OF ENGINE FTS TEST	
			Analyze engine FTS test data. Report results	17
			of data analysis.	



	Event Number	Description and Criteria	Event Number	Description and Criceria	Event Number	
	12	COMPLETE SUSTAINING ENGINEERING FOR 100 HOURS FLIGHT TEST End of Phase III. Completion of 100 hours of flight testing.	18	CONTINUOUS INLET DYNAMIC COMPATIBILITY AMALYSIS Start continuing analysis of dynamic compati- bility data. Analysis of data is in process.	24	HUDEL Comple specit
	13	START CERTIFICATION PERFORMANCE ANALYSIS Start analysis of data from Certification performance test. Analysis of data is in process.	19	START ADVANCED ENGINE FERFORMANCE ANALYSIS Start analysis of advanced engine performance. Analysis is in process.	25	MODEL Complete
rs ude • * .	1+	UNOFFICIAL CERTIFICATION TEST Reference engine network 1.06 for description and criteria.	20	MODEL AND PERFORMANCE SPECIFICATION Complete update of engine model and performance specification. Issue preliminary specification.	26	HODEL / Complet specifi
	15	ENGINE CERTIFICATION Reference engine network 1.06 for description and criteria.	21	MODEL AND PERFORMANCE SPECIFICATION Complete update of engine model and performance specification. Issue preliminary specification.	27	PERFORM SYSTEM Start
it.	16	CONTINUE COMPONENT PERFORMANCE ANALYSIS Continue analysis of component test data. Analysis of component test data is in process.	22	Name: AND PERPURMANCE SPECIFICATION Complete update of engine model and performance specification. Issue preliminary specification.	28	START E
	17	START CONTROL SCHEDULE ANALYSIS Start analysis of control schedules. Analysis of control schedules is in process.	23	MODEL AND PERPONNANCE SPECIFICATION Complete update of engine model and performance specification. Issue preliminary specification.		mission analysi



24

Description and Criteria

MCDEL AND PERFORMANCE SPECIFICATION Complete update of engine model performance specification. Issue preliminary specification.

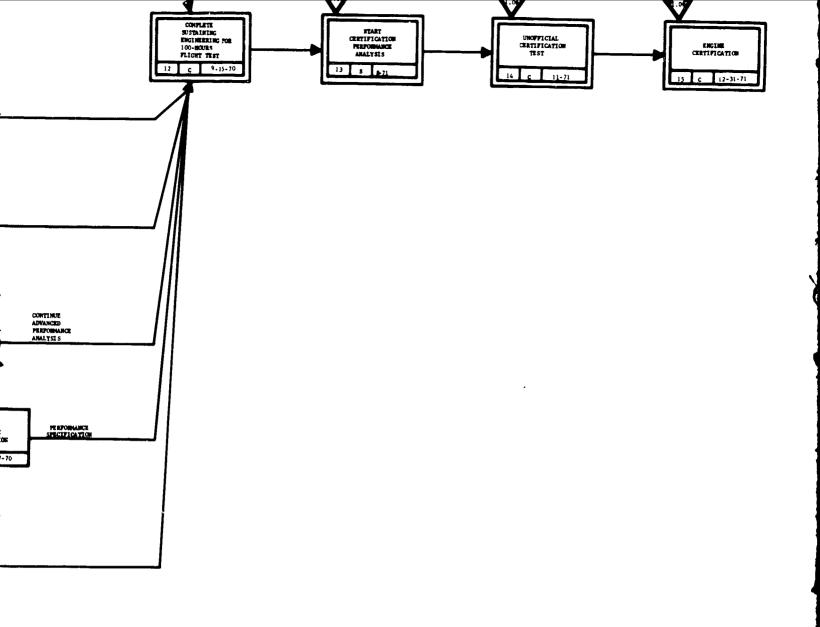
MODEL AND PERFORMANCE SPECIFICATION Complete update of engine model performance specification. Issue preliminary specification.

HODEL AND PERFORMANCE SPECIFICATION Complete update of engine model performance specification. Issue firm specification.

PERFORMANCE ANALYSIS OF INTEGRATED CONTROL SYSTEM TESTS Start analysis of data from integrated control system lesss. Analysis of data is in process.

START ENGINE-AIRPRAME-AIRLINES MISSION AMALYSIS Start analysis of engine-airframe-airlines mission information. Information exchange and analysis in progress.

9



FD 17653 VH

PWA FP 66-100 Volume V

1.08 INLET SYSTEM COMPATIBILITY

A closely coordinated effort will be maintained with the airframe manufacturer to make maximum use of all available data affecting the compatibility of the JTF17 engine and inlet with respect to inlet distortion for both steady-state and transient operation. This effort is described in detail in Inlet System Compatibility, Volume III, Report D, Section II. Experience gained on the J58 project and other Pratt & Whitney Aircraft engine high Mach number applications will be directly applied to this program. Inlet steady-state and dynamic characteristics as obtained from the airframe manufacturer will be included in the computer programs. This will be augmented by the data obtained during the engine/inlet compatibility tests conducted by the airframe manufacturer in cooperation with Pratt & Whitney Aircraft.

The airframe manufacturer's inlet model tests will provide an initial indication of the distortion patterns to which the engine will be subjected. These patterns will be duplicated with appropriate screens installed ahead of the P&WA fan rigs. Tests run with these screens will demonstrate the attenuation of this distortion that is provided by the fan. This attenuating characteristic is essential to the development of an engine which will operate surge free and without performance loss with a distorted inlet flow field. In addition to duplicating the inlet model distortion patterns, screens will be constructed to provide additional data of a more general nature on the effects of distortion on fan performance. These data will be used to improve the analytical simulation of distortion effect in our fan and compressor performance prediction systems. A Phase II-C engine will be modified to permit early evaluation of the fan to high compressor interactions. In addition, the fan rigs will be modified to permit a controlled circumferential variation in the engine side discharge flow. This will be used to simulate the distortion attenuating influences of the high compressor. These data will also be used to improve our analytical systems.

A second phase of the fan rig test program will call for testing of a simulated subsonic diffuser of the aircraft inlet duct. This will impose the static pressure gradients produced by the fan on the diffuser and will permit an evaluation of its performance under more realistic operating conditions than were possible during the airframe manufacturer's model tests. This testing is intended to provide early mating of the inlet and compressor in time to permit early corrective action.

Early in the development program, full-scale engine testing will be conducted with distortion screens similar to those described above. These tests will provide a demonstration of the engine's insensitivity to the distortion produced by the inlet. Later tests will incorporate a fully simulated inlet duct. This duct will be used initially to demonstrate satisfactory operation urder takeoff and approach conditions.

Refinement of the computer simulation of the engine/inlet system will continue and engine and rig test data will be used to ensure the validity of the simulation. This wil be closely coordinated effort by both the engine and the airframe manufacturer. As new inlet model test data are obtained, the inlet simulation will be revised to include significant changes in dynamics or concept. Engine and control test program data will

PWA FP 66-100 Volume V

be used to check the validity of the engine simulation gains and time constant. The computer simulation can then be used concurrently during the test programs to ensure that desired stability and performance requirements are met. This will begin a continuing cycle of test, refinement of simulation, analytical studies and further tests. The program will evaluate phenomena such as the effect of variable gains, deadband, random noise, interaction between the control, engine, and inlet; and interaction between control components for the effects on the overall system. These simulations will also be expanded to reflect efforts of distortion and certain failure modes.

The simulated subsonic diffuser portion of the inlet duct, the boundary layer bleed system, the bypass system and their associated controls will be used to demonstrate dynamic compatibility with the engine during simulated high Mach number operation. These tests will also provide a performance check on any diffuser modifications that may have resulted from earlier rig tests.

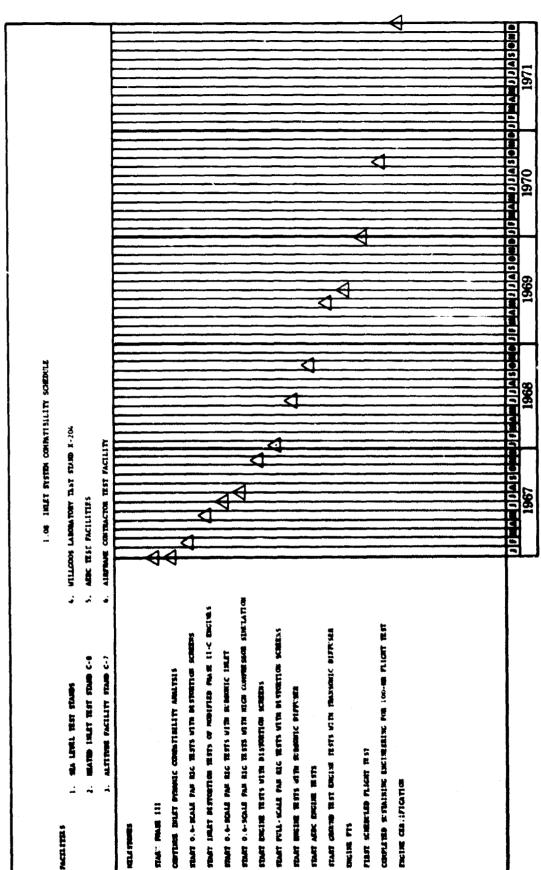
The complete propulsion package compatibility demonstration is scheduled to be performed in the AEDC wind tunnel facility at Tullahoma, Tennessee. The details of this program have been negotiated and will continue to be coordinated between Pratt & Whitney Aircraft and the airframe manufacturer. The thorough test evaluation which precedes the AEDC program will minimize any problems which might be associated with the inlet diffuser, the engine, or their control systems. This early development work will materially reduce the cost of the AEDC tests and minimize the time required to provide a compatible propulsion package for flight test.

The major milestones, network chart and event dictionary for inlet system compatibility are shown in figures 15 and 16, respectively.

Test planning and integration of inlet system compatibility is presented in Test, Volume IV, Report E.

Pratt & Whitney Aircraft
PWA FP 66-100
Volume V

FD 17866 VH



野猪

Figure 15. 1.08 Inlet System Compatibility

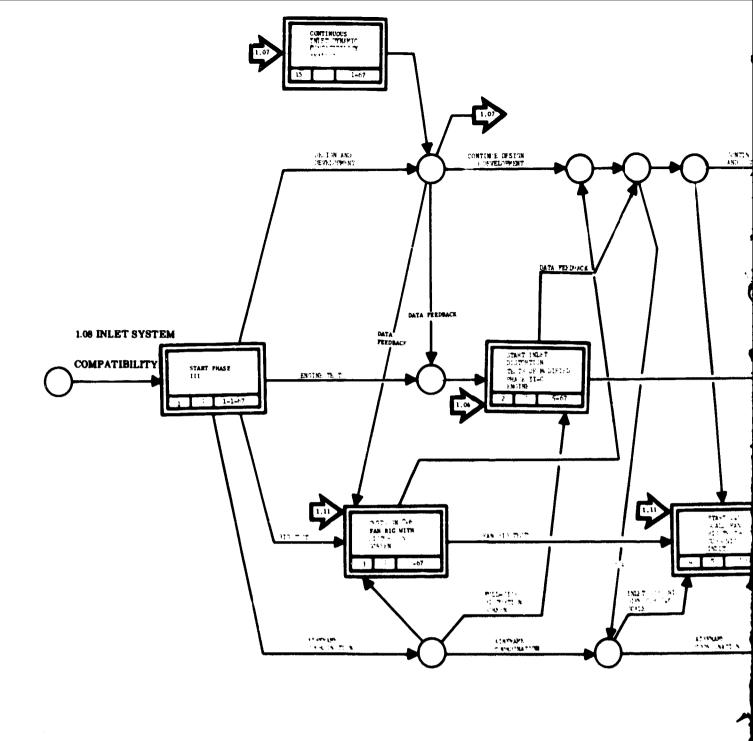
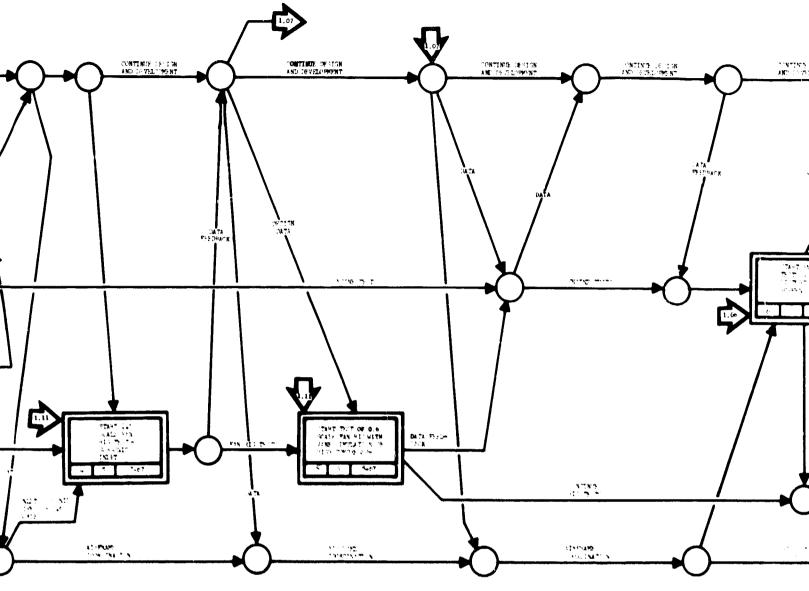


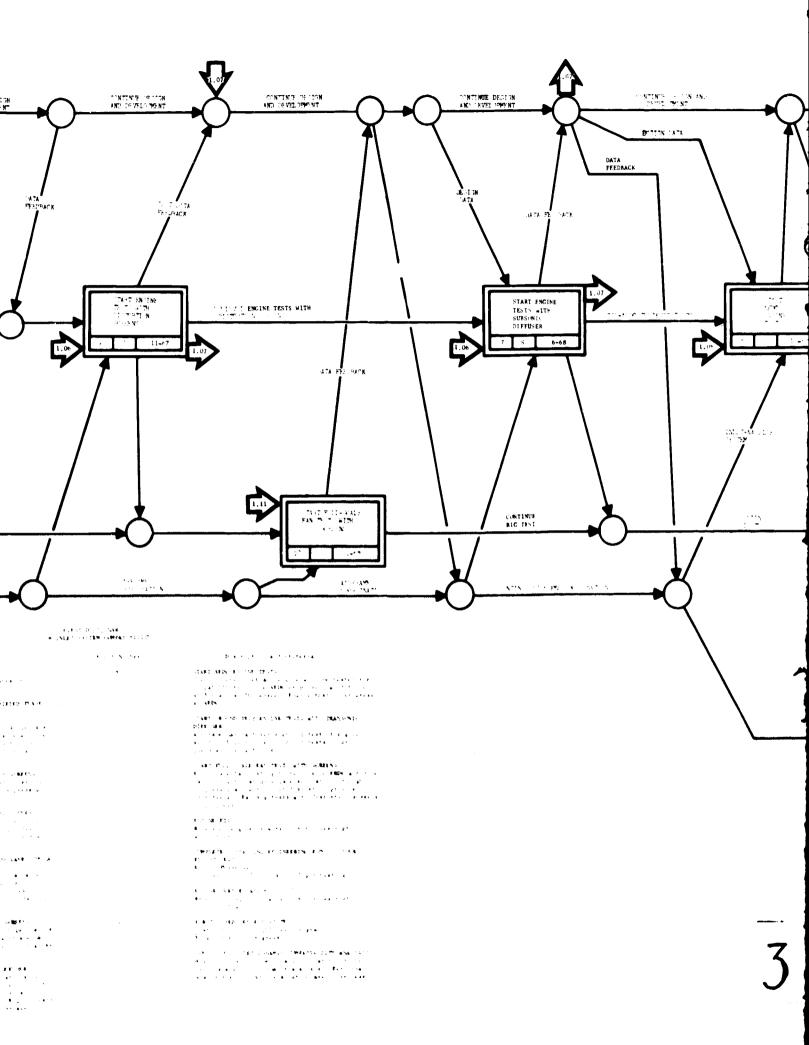
Figure 16. 1.08 Inlet System Compatibility

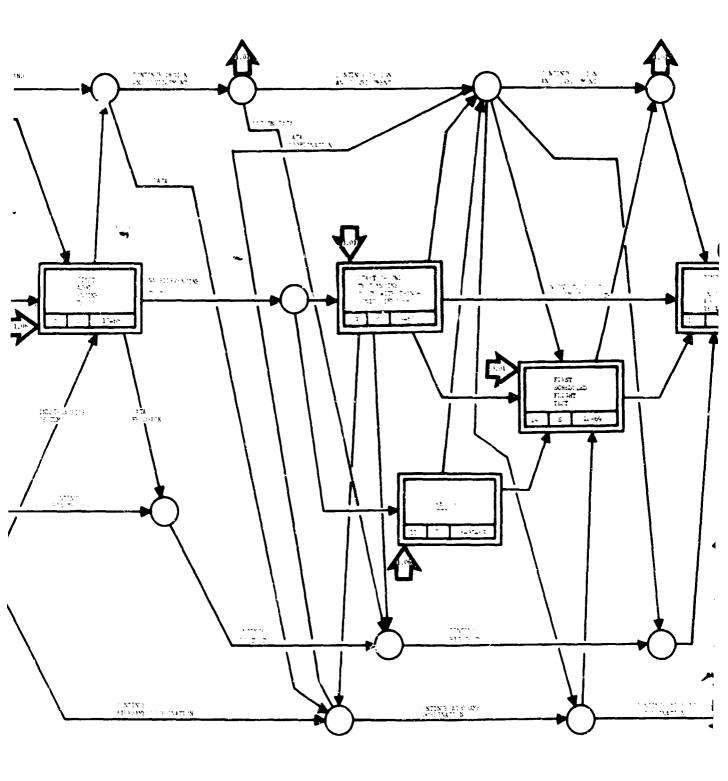


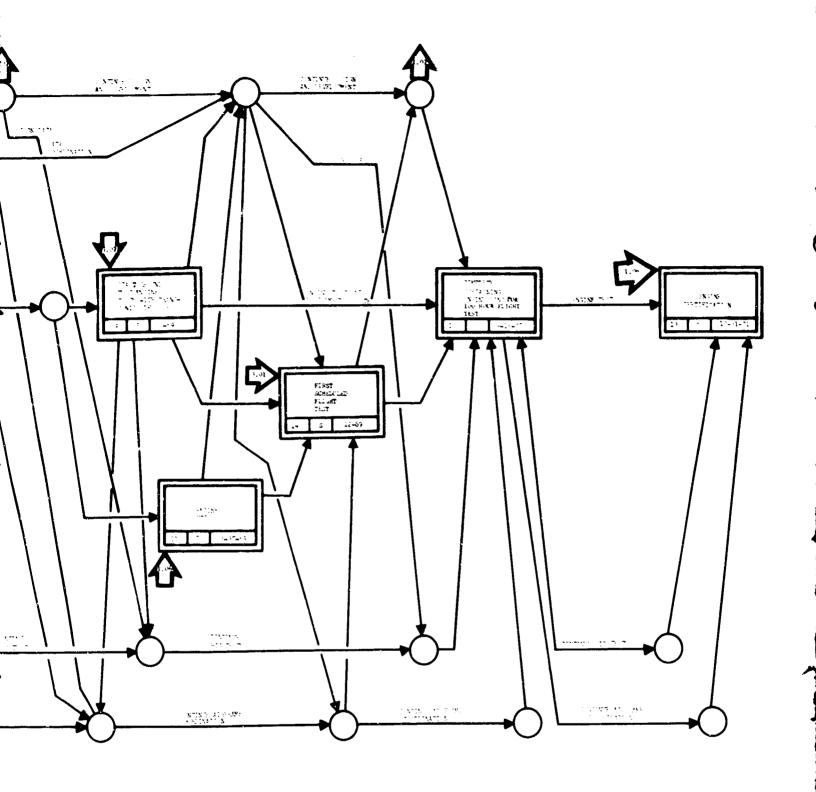
SUPPLE DISTRIBUTE SUB-

		TO STREET CHARGES IN
Liest Nober	Decay of the second of the second	
	START PRASE III. Prose for a real control of the first	•
	Cased Unitary of Commonty Courts of the Mynoperes of the History of the Stage of the Court of th	
	Taking Jacobs David Birding State (A. 1997) A. A. S. S. S. A. A. S.	
	mono milio si san ani anti con ancio il Matti Pravi rivera il Silvini al III al III al III a Pravi il anni rivera di san il Senti il III al III a	
	Commission of the parties of the par	
	SECURIOR OF THE SECURITY OF TH	
	Single ready of the analysis of the second o	
٠	START AS UNE DESCRIPTION OF THE STARTS OF TH	٠
	START ENGINE METER AND COUNTY SERVICES OF THE RESIDENCE O	12

1.08 Inlet System Compatibility







PWA FP 66-100 Volume V

1.09 NOISE

The JTF17 engine noise suppression program will be directed toward (1) the attenuation of fan noise and (2) the attenuation of exhaust gas noise. The first will pursue methods of fan noise attenuation including fan spacing and application of acoustical liners to the diffuser section of the fan duct. The second will be concerned with methods of exhaust gas noise attenuation and include analyses of the effects of engine nozzle geometry and reverser-suppressor geometry as well as exhaust noise suppressors similar to those in current commercial use.

Analyses of fan noise generation which have been completed by P&WA indicate that the strength of the audible noise is proportional to the pressure differential across the blades and vanes. Reduced pressure differentials can be obtained by such methods and slotted blades and high-lift devices which provide no reduction in the total force acting on the airfoil. Narrow band frequency analyses of resultant effects upon noise will be conducted. Configurations found to be of significant value in rig tests will be evaluated further during full-scale engine tests.

The evaluation of fan noise modifications will begin early in Phase III with an investigation of vane angle effects in the 0.6-scale rig. This work will be performed concurrently with other investigations on the same rig into the effects of blade loading and the generation of combination tone noise. The full-scale compressor rig will be used to determine optimum rotor/stator spacing and vane numbers. An evaluation of the factors which have been found to have an important effect on the generator of combination tones will also be conducted in the full-scale rig.

An evaluation of acoustical liners will begin with impedance tube tests early in Phase III. Both resonant and nonresonant liners will be tested for application in the diffuser section of the fan duct to absorb noise. The results of these tests will be used to select a liner with optimum absorption in the required frequency ranges. The impedance tube tests will be conducted under flow conditions similar to those which exist in the engine fan duct. The results of tests of this type completed during Phase II-C will allow an early evaluation of liners in a JTF17 engine. Fan design modifications resulting from rig tests as well as final development of acoustical liners will be conducted on a development engine. Installed acoustical liner tests will be conducted to:

- 1. Verify the results of the liner selection program
- 2. Determine optimum liner locations

THE PART OF THE PA

3. Measure fan noise transmitted through the fan duct with the liners installed.

Since analytical methods for the evaluation of exhaust system geometry changes on exhaust gas noise do not exist, all development work of exhaust noise suppression devices requires the use of model or full-scale tests. An analysis of the effects of nozzle and ejector geometry upon exhaust gas noise will be conducted on a component model test stand. Tests of exhaust noise suppression devices will be started on this facility at the same time. All model test sound recordings will be subjected to 1/3 octave

PWA FP 66-100 Volume V

band filter analysis and compared to base tests of models without suppression devices. Boilerplate versions of the best configurations from the model tests will then be tested on a JTF17 engine.

In addition to providing a final evaluation of selected suppressor devices, engine tests will be conducted on the noise test stand (A-9) to measure accurately engine noise levels and evaluate available operational techniques. Operational techniques to be evaluated include:

- The reflection of fan noise upstream during operation of the duct heater at low engine power settings
- 2. Improved matching of the noise produced by the primary and duct exhaust gases.

Salient features of the noise test stand are:

- Engine centerline height greater than two nozzle diameters above the ground
- 2. Clear and level ground extending for a distance of 500 feet from the engine
- 3. On-site facilities for meteorological measurements
- 4. Thrust and engine parameter recording capability
- 5. Permanently located microphone positions
- 6. Low background noise levels.

The major milestones, network chart and event dictionary for the noise program are shown in figures 17 and 18, respectively.

A detailed description of the noise program is presented in Noise and Suppression, Volume III, Report C, and test integration of the noise program activity is presented in Test, Volume IV, Report E.

PWA FP 66-100 Volume V

FD 17867 VH

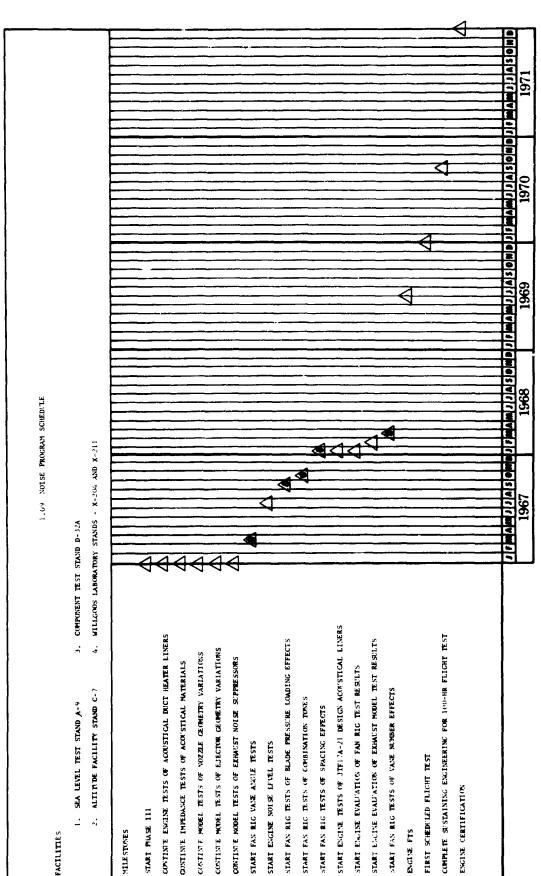
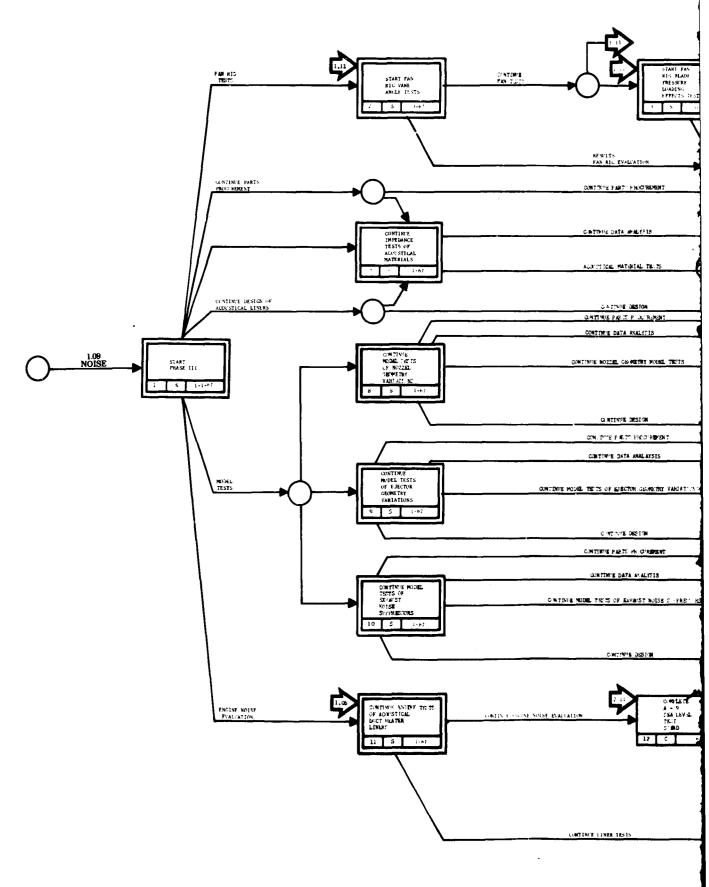


Figure 17. 1.09 Noise

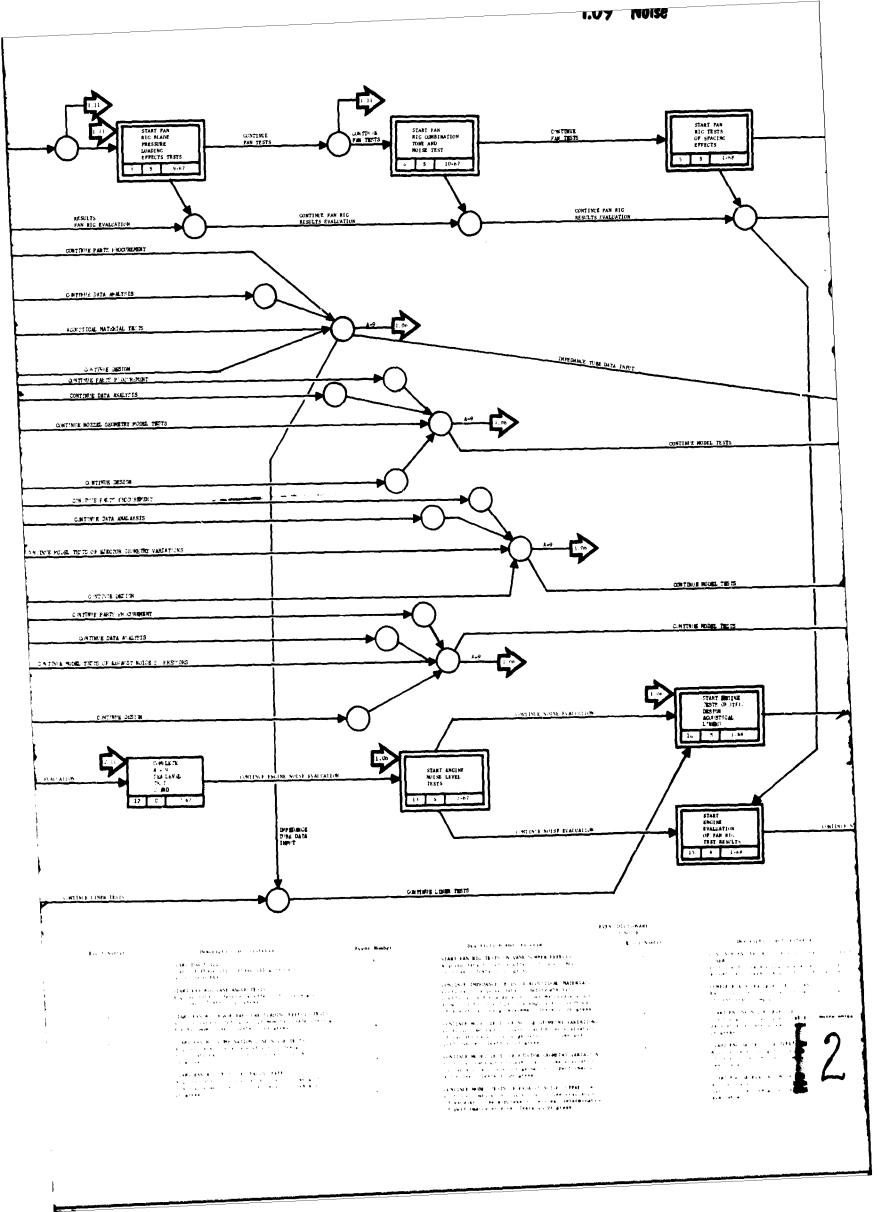
ENGLISE FTS

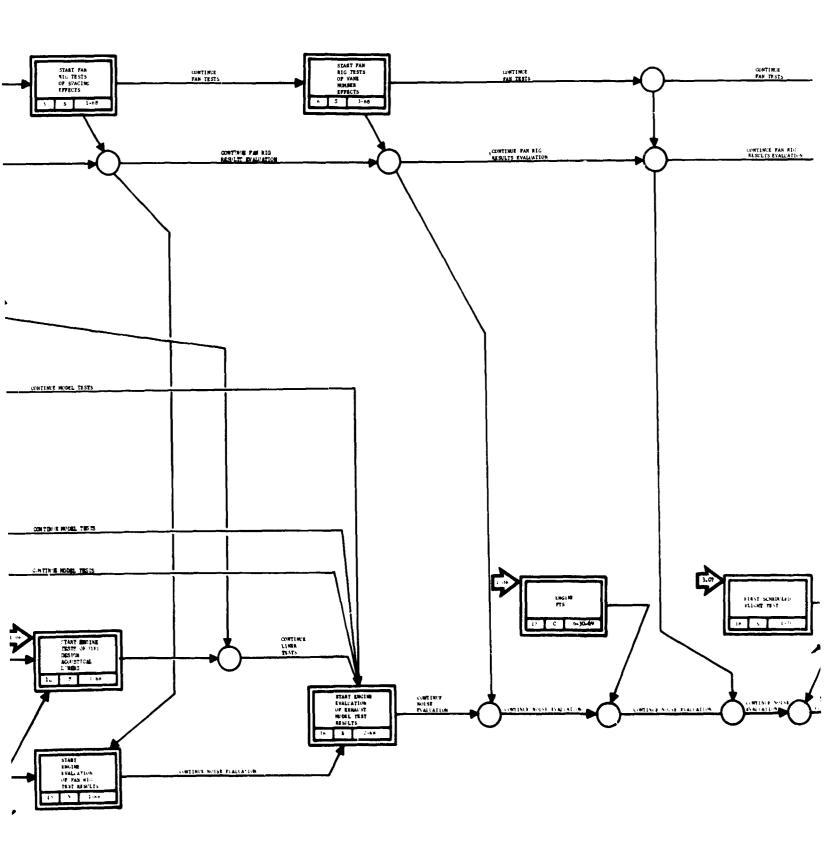
START PIASE 111

FACTLITIES



Event Supper

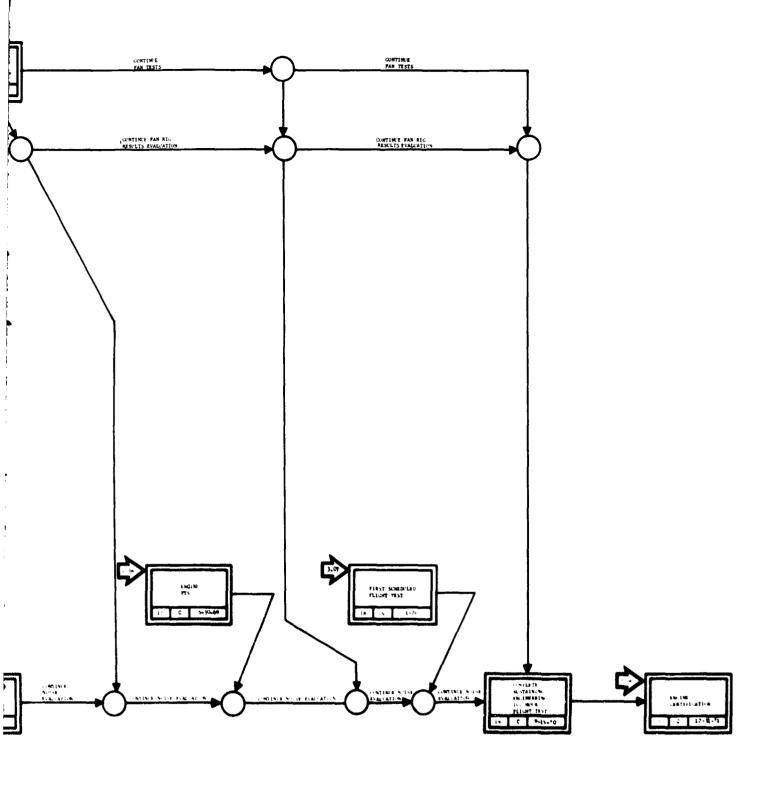




manager attricteria	150
A No. Note that the property of the second s	
The second secon	
$\frac{d \Phi_{ij}(\mathbf{r},\mathbf{r})}{d r} = \frac{d \Phi_{ij}(\mathbf{r},\mathbf{r})}{d r} + \frac{d \Phi_{ij}(\mathbf{r},\mathbf{r})}{d r} + \frac{d \Phi_{ij}(\mathbf{r},\mathbf{r})}{d r} = \frac{d \Phi_{ij}(\mathbf{r},\mathbf{r})}{d r} + d $	
A contract of the second of th	
A SECTION OF THE PROPERTY OF T	
A TANK OF THE REPORT OF THE PARTY OF THE PAR	

CARRET PROCESS AND AND PROCESS OF MANAGEMENT Characteristic form of the property of the pr

Fig. 1. The second of the seco



4

1.10 GROWTH POTENTIAL

The growth of the JTF17 engine after introduction to commercial service is directed toward the following improvements:

Improved Performance

Increased takeoff and transonic thrust Reduced Mach 2.7 cruise TSFC Reduced noise Increased operating envelope, particularly to Mach 3 or above

Increased Parts Life and TBO extension

Reduced Specific Weight

During Phase III the JTF17 development effort for growth will be directed toward the above objectives in four major areas:

- Engine-airframe mission analysis in cooperation with the airframe contractor to direct efforts toward areas of greatest gain for engine growth in terms of airplane economic direct operating cost (DOC) and return on investment (ROI) and reduced noise.
- 2. Design studies of engine modifications incorporating advanced component performance or features which would improve the JTF17 engine in the growth items listed above.
- 3. Continued research and advanced development of components for improved performance and noise generation and suppression knowledge.
- 4. Continued research and advanced development in materials seeking to (a) improve quality and properties of existing materials, (b) develop higher strength-weight alloys for disks and cases, particularly titanium and nickel base alloys, (c) develop coatings for titanium and turbine blades and vanes to inhibit stress-corrosion, exidation-erosion, and sulfidation.

The major milestones, network chart and event dictionary for growth potential are shown in figures 19 and 20, respectively.

A detailed description of growth potential is presented in Growth, Volume III, Report G.

PWA FP 66-100 Volume V

FD 17868 VII

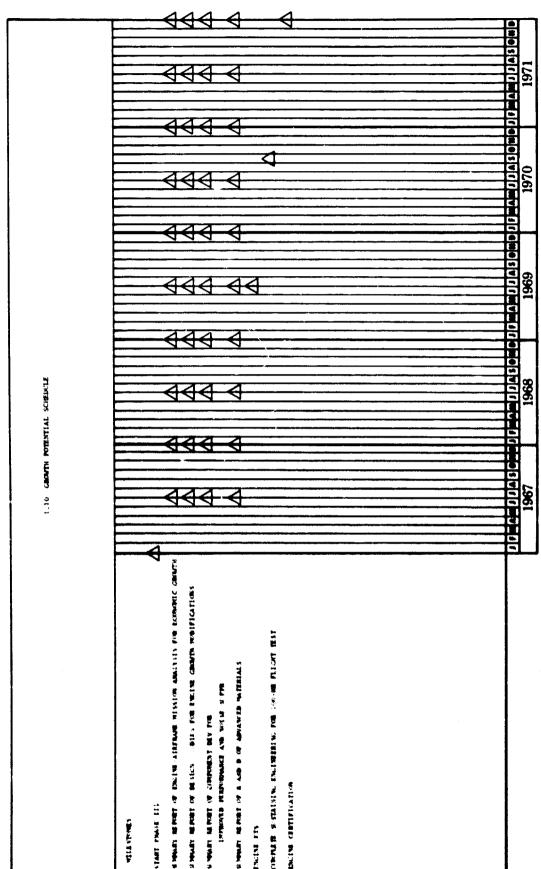


Figure 19, 1.10 Growth Potential

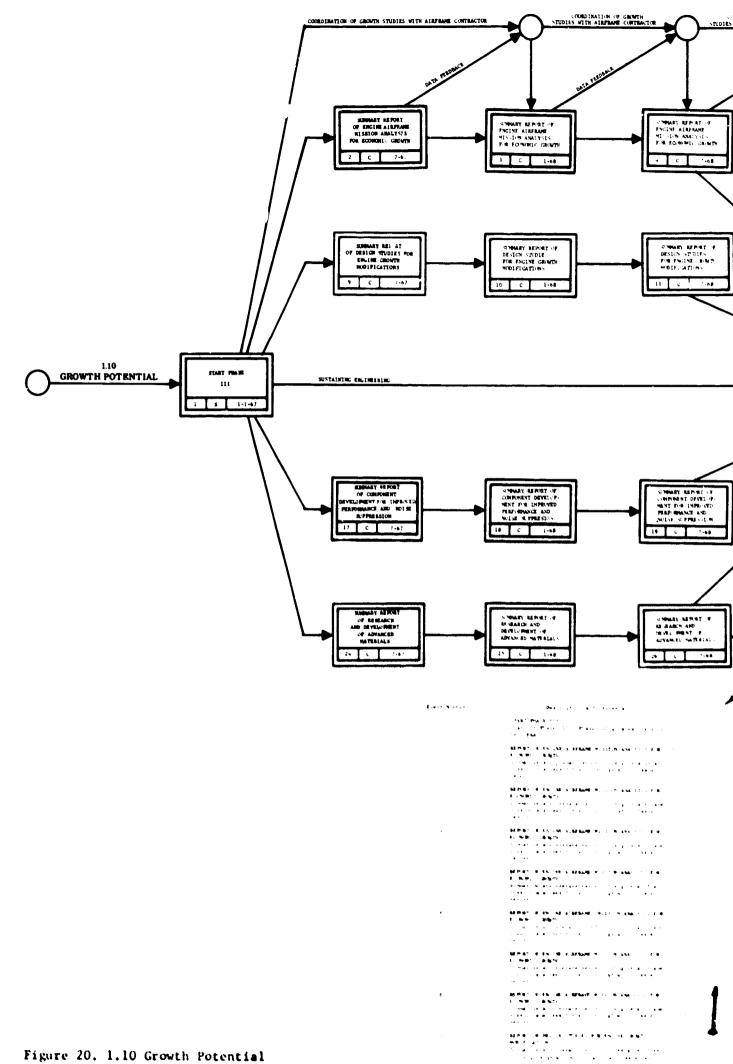
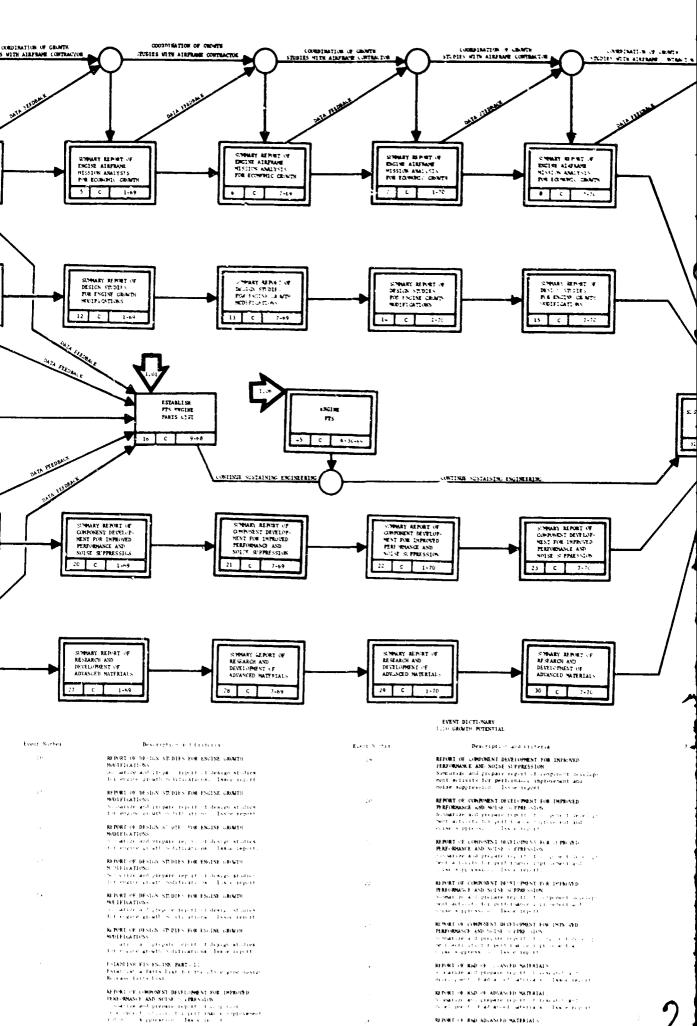


Figure 20, 1.10 Growth Potential

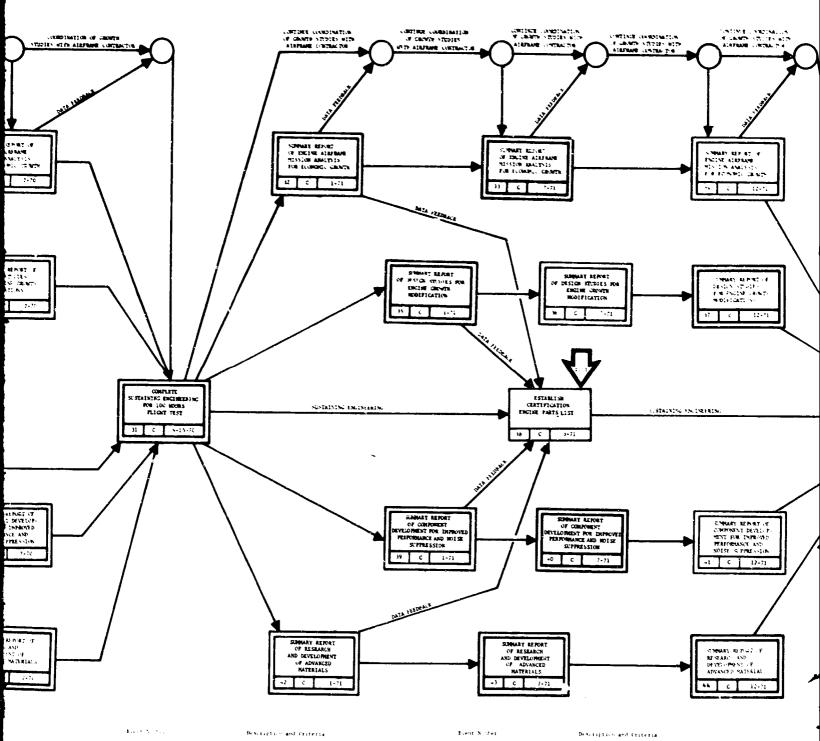


REPORT OF COMPONENT PROFESSIONAL THROUGH PRESIDENCE AND NOTE OF PRESIDENT SCHOOL OF A DESCRIPTION OF THE SECOND SCHOOL OF A DESCRIPTION OF THE SECOND OF THE REPORT OF AND ADVANCED MATERIALS

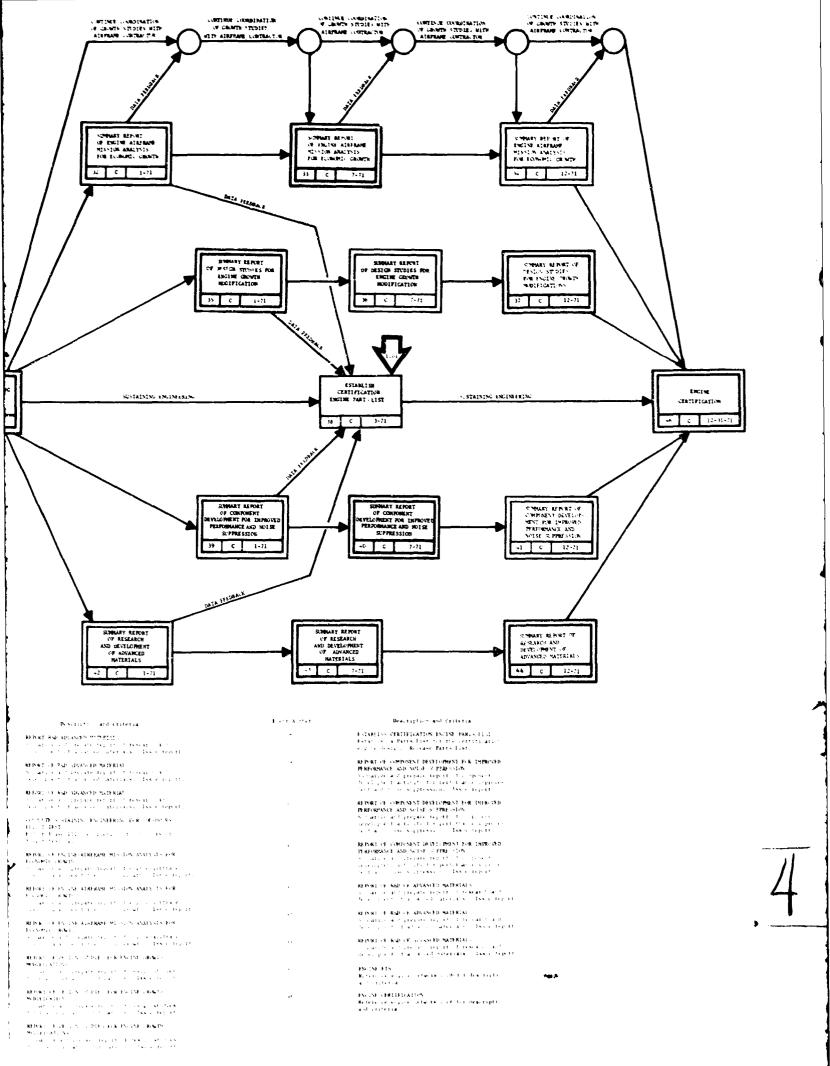
TO DESCRIPT A CLEEK THE ROPE TO TOSTARD AND DESCRIPT AND THE PROPERTY OF T

REMORE OF RISE ADS. NEED MATERIAL .

The deleter of propage from the fitness of a condition of propage from the above as Scholleger and the second of the consequents.



A STATE OF CONTROLS THE TENSOR AND STATE AND ADDRESS OF THE STATE OF T						
AND STATE OF THE PROPERTY OF T	S Evely PART - 11st	ESTABLISH CERTIFICATION END	*		8	noVED
STATE OF STA	e Parts L. st.	Charle de Signa Benease Part		eres part taria ses afersass. Iss e tepert		
PART OF CONTROL OF THE ACCOUNT OF TH	VET CPMENT FOR IMPROVED	REPORT OF COMPONENT DEVELOP	19		~	
BIRKLY REPRODUCTIONS A STATE OF STAT	topolitic to proper	Nevertier and prepare tep-er		So with our analysis series of the surprise of another than the series of the serie		N/5 FD
REPORT OF CONTROLL STATES OF COLUMN STAT	i fortler alle springere. No bestroken repeter	one and the second of the second seco		REPORT OF RISD ADVANCED MATERIALS	•	
OWERT STATEMENT OF	VII OPMENT FOR IMPROVED	REPORT OF COMPONENT DEVILOP	19	(a) After a distribute topolity of testing and control for the first seed afterwards. Testin report;		,
Post Pasco III Complete of company of the state of the st	tep tit i pagera	Not with the and property they be				San S
BONKE OF PAGES ARREAD MISSION ANALYSIS FOR PARAMETERS ANALYSIS FOR PARAMETERS AND MISSION PROPERTY OF THE PAGES ARREAD MIS	series les regert	that And other Suppress.		For a Phase III to profess our construction		
REPORT OF DATA ARREADI MES POR AMAS AS DOS FORMATION ARREADING MES POR	VELOPREST FOR INPROVED	REPORT OF COMPONENT DEVELOPE				
SPEKT OF BOTTON ADDRESS OF TOTAL ORDERS SPECT OF BOTTON ADDRESS OF TOTAL ORDE	STPPRE-ISTON	PEREORMANCE AND NOTNE SCIPPRE		REINRY OF ENGLISH ATREBAMIC MICHIGAN ANALY (LA FORE	*,	e- vED
SERVET OF PACIFIC MARKET OF PA	the state that we have a state of	Sixe, and a finite fit pay				
FASTER SALES STORY OF THE STORY	so les copere.	4 1 41 St. A. (1914 Sec.)		the control of the co		
A DESCRIPTION OF THE PROPERTY		REDIST OF RND OF ADVANCED MA	•			
ADDRESS AND RESTRICT END ADDRESS AND SETS AND SE	d aterials lass regist	to explore of attacked and		School of Asia Despute they be able to a produce		s spp
HONOR AND	FD MATERIAL .	REPORT OF HISD OF ADDANGED MA	4.2			to some
REPORT OF THE STATE OF THE STAT	trontt d'anneau Calor. C'anternate dans rogert	n andtstera Coppepate to site fore product define on a was				T"
BONG OF DESCRIPTION BONG OF DESCRIPTION BOUGHTATIONS STORY OF THE S	·					
DENS OF DESCRIPTION O			•	Street Advisor Charles and Appendix Charles are great		
Reference of the control of the cont		delen geleit faglandet same				1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 -
REPORT OF DELICE OF DELICE SAME OF THE STATE OF THE SAME OF THE SA		ENCORE ECS				
REPORT OF DEPOS OF DE	trook for description	Reference a procession of the con-				
AFFORD A STATE OF THE STATE OF			**			
APPART SO DESCRIPTION OF DESCRIPTION OF SOME SOME SOME SOME SOME SOME SOME SOME	re i of the beautique.	Riterio a lenga e caracra a co				
MADE CATION :		and statetsa		the community of the control of the		
		-				
AMERICAN ACCUSED AND AND AND AND AND AND AND AND AND AN						
the second control of				the second second of the second second second second		



1.11 FAN AND COMPRESSOR

The 0.6-scale fan rig, used throughout the Phase II-C program, will be rebuilt to the prototype configuration at the initiation of the Phase III development. Initial testing will define the as-designed fan performance of the JTF17 prototype engine and provide the data from which fan development will begin. A second 0.6-scale fan rig will be added to the program to provide the added test effort required for an early start on inlet compatibility testing and noise suppression studies. The details of compressor development aimed primarily at noise attenuation and inlet compatibility are described in Noise and Suppression, Volume III, Report C, and Inlet System Compatibility, Volume III, Report D, Section II.

The scaled rig testing will be replaced by full-scale fan testing when test facilities become available in Phase III. The program will build up to three of the full-scale rigs which utilize engine hardware.

Throughout Phase III the fan rig testing will be utilized to evaluate performance and determine the necessary aerodynamic changes to the blades and stator vanes for performance improvement, and inlet compatibility or noise attenuation as the overall engine development program may require. Frequent tests incorporating strain gage instrumentation will reveal any resonant or aerodynamic vibration problems associated with the fan so that correction can be made before they develop into engine problems. The fan program will include fan rig tests at heated inlet conditions to ensure that the fan is free of aeroelastic stress or mechanical vibration problems under all operating conditions.

The high compressor program will utilize three full-scale compressor test rigs which duplicate the aerodynamic and structural configurations of the engine compressor. As with the fan the first testing accomplished early in Phase III will define the performance of the prototype high compressor and provide the data from which the high compressor development can begin. Continuing from Phase II-C, the high compressor rig program will evaluate and develop overall compressor performance as necessary to meet engine goals. All stages of the compressor will be strain gaged to monitor and record any significant vibration stresses attributable to natural resonance of the parts, or aerodynamic excitation. This testing will include heated inlet running to determine the effects of high Mach number operation on performance and stress.

To provide the extended low cycle disk life necessary for the supersonic transport, the design of the high compressor incorporates features to reduce disk thermal stresses during transient operations to and from high Mach number operation. The high compressor rig will be assembled with disk temperature instrumentation to evaluate the effectiveness of the disk cooling scheme.

Compressor and fan rig testing cannot be considered as meaningful as engine endurance testing to develop the durability of the compressor. However, the repeated surges and off-design operation of these rigs is in some respect more severe than engine endurance and will provide excellent substantiation of blade shroud designs as well as general airfoil and disk designs.

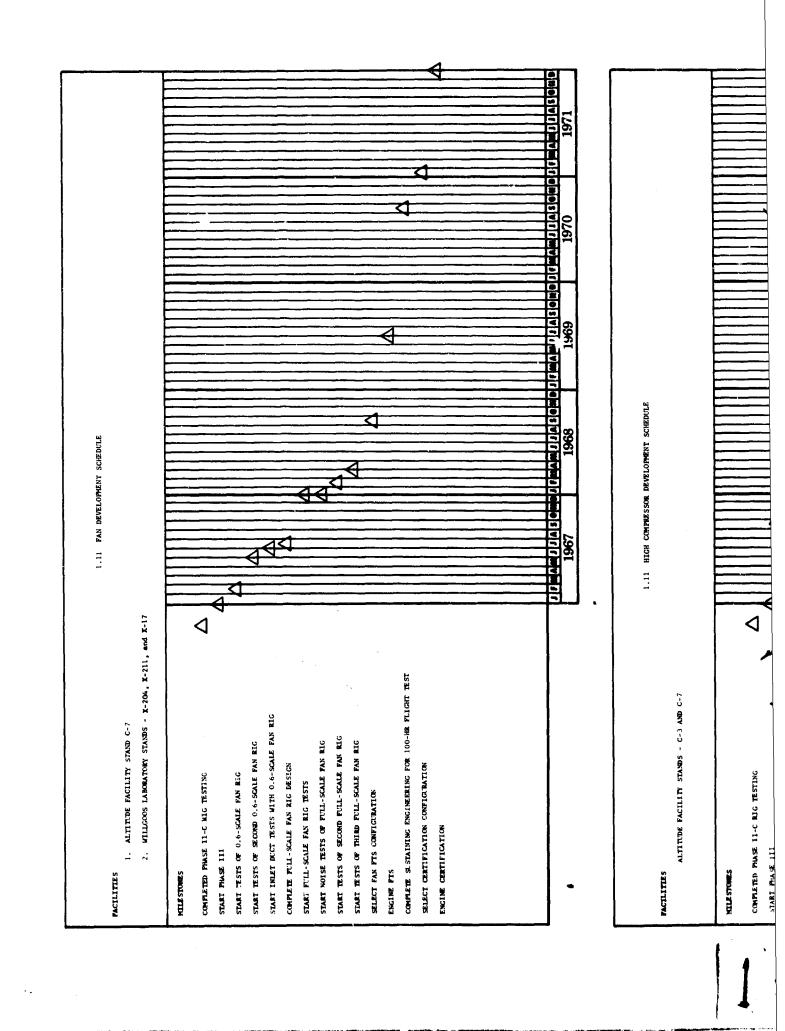
The second second

PWA FP 66-100 Volume V

> The compressor rig and engine test program will be supplemented by an extensive materials evaluation and development program. The details of this program, which will include high and low cycle fatigue, stress rupture and extended creep testing of compressor materials, are contained in Manufacturing Techniques and Materials, Volume III, Report F. The fan and high compressor sections of the JTF17 engine are designed to provide blade containment so that a possible blade failure will be contained to prevent external damage. Because compressor rig testing and early operation of the prototype engines will undoubtedly result in off-design operation, the probability of a fan or compressor blade failure will be high. Any such failure will of course be fully analyzed for the cause of failure; in addition, the compressor case containment will be evaluated and the design revised if necessary. A lst-stage fan blade will be intentionally failed in a spin pit test to verify the containment of the fan section since this represents the most severe containment requirement of the engine.

The major milestones, network chart and event dictionary for the fan and compressor are shown in figures 21 and 22, respectively.

A detailed description of fan and compressor development is presented in the Test and Certification Plan, Volume III, Report E, and test planning and integration is presented in Test, Volume IV, Report E.

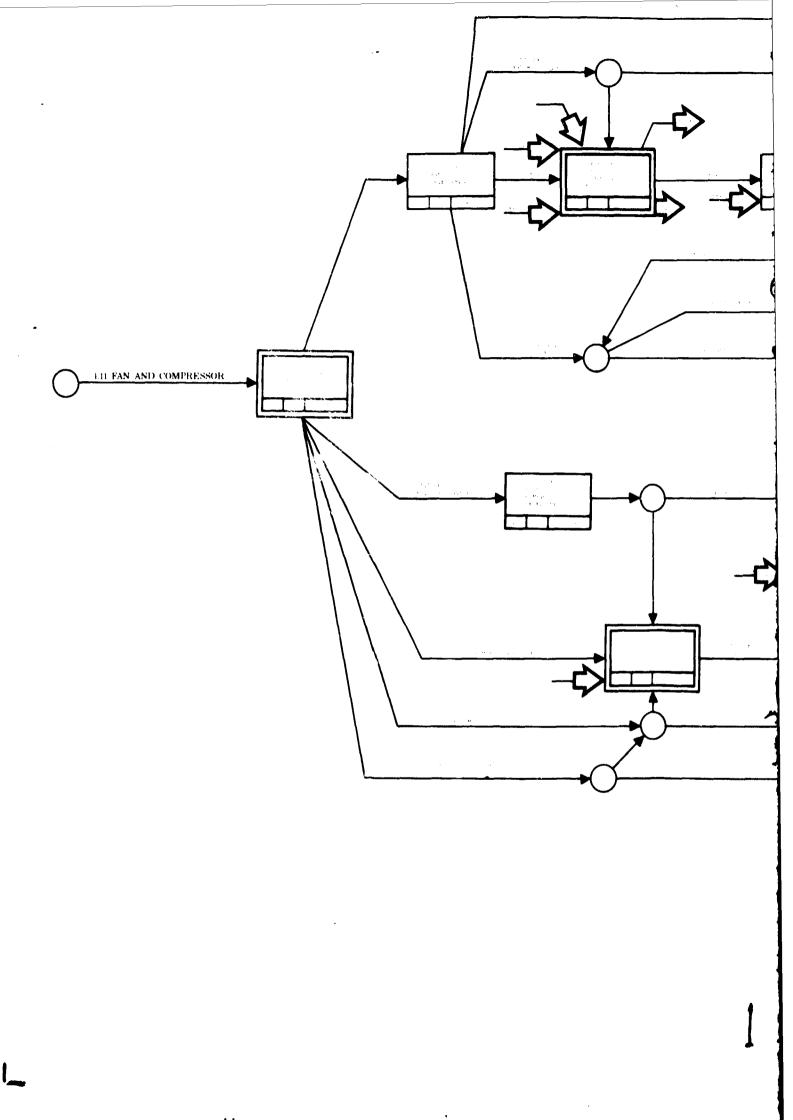


PWA FP 66-100 Volume V

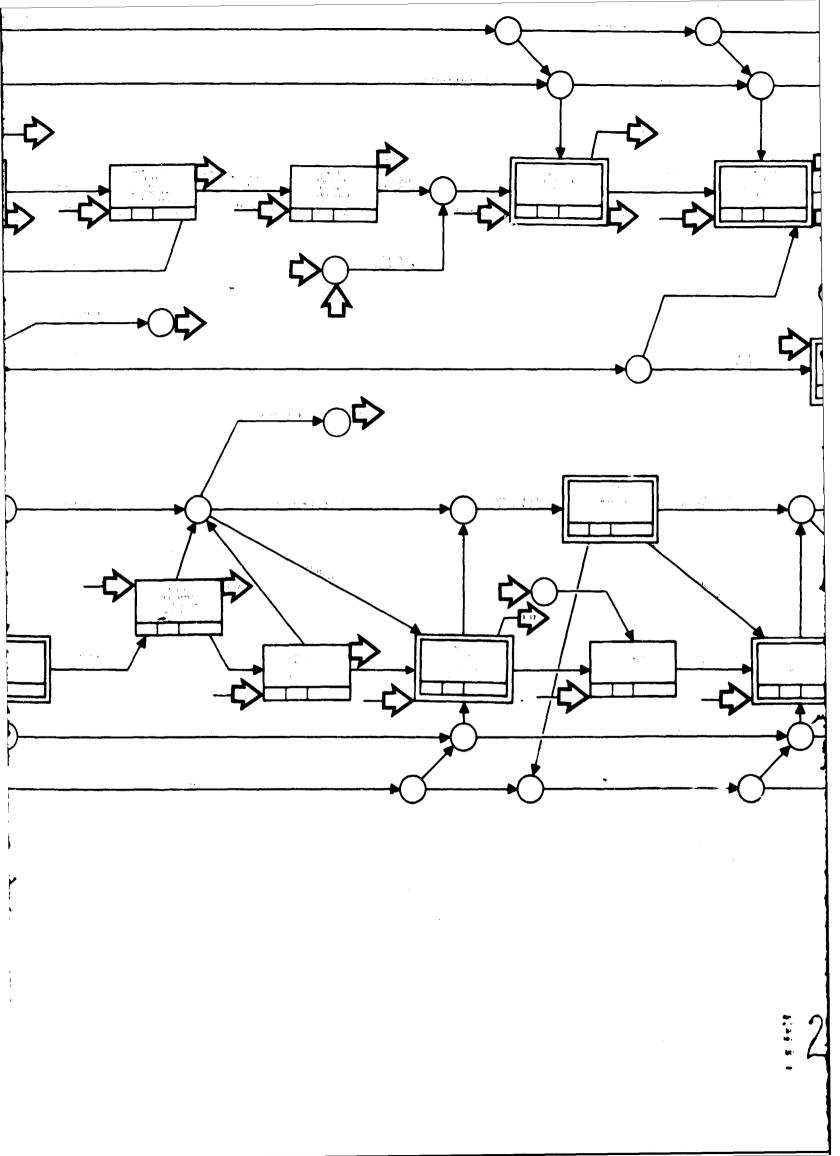
FD 17869 VH

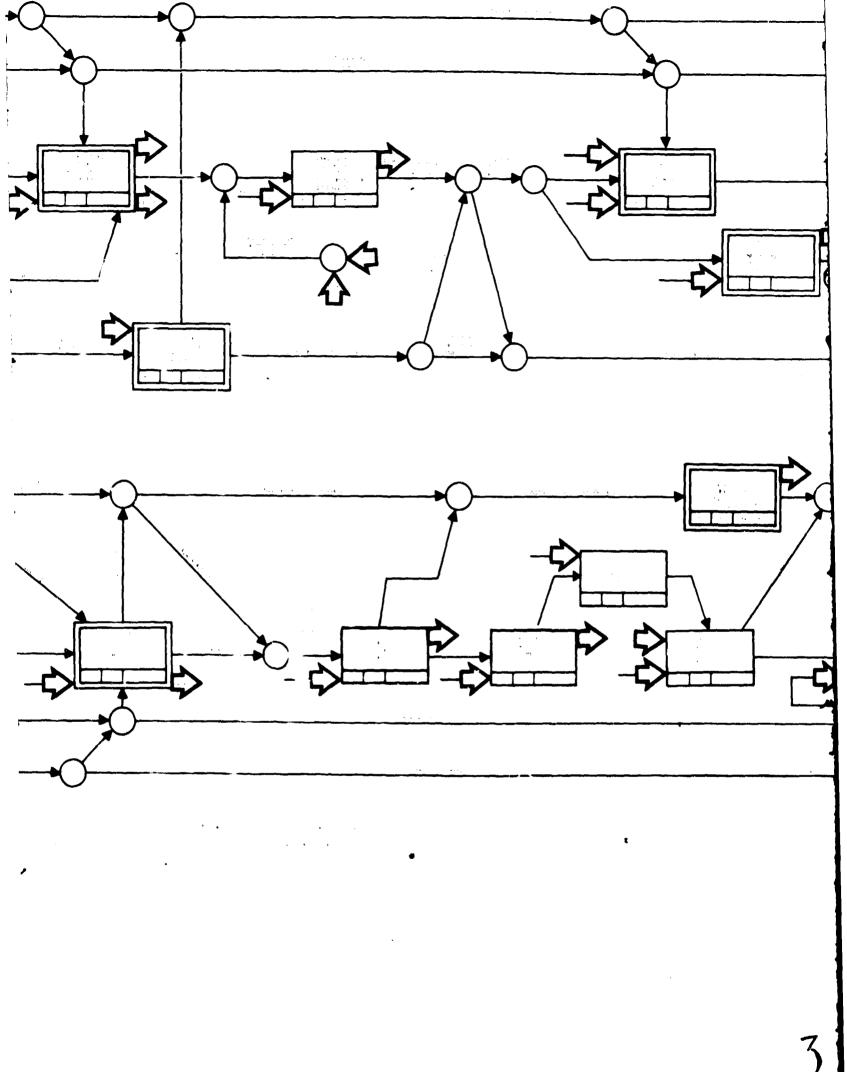
1971 1970 1969 1.11 HIGH COMPRESSOR DEVELOPMENT SCHEDULE 1968 4 COMPLETE SUSTAINING ENCINÉERING FOR 100-HR FLIGHT TEST ALTITUDE FACILITY STANDS - C-3 AND C-7 START TESTS OF SECOND COMPRESSOR RIG START PHASE III COMPRESSOR RIG TESTS PINALIZE THIRD COMPRESSOR RIG DESIGN START TESTS OF THIRD COMPRESSOR RIG SELECT COMPRESSOR PTS CONFIGURATION SELECT CERTIFICATION CONFIGURATION COMPLETED PHASE 11-C RIG TESTING ENCINE CERTIFICATION START PRASE 111 PACILITIES ENGINE PTS CLL STORES

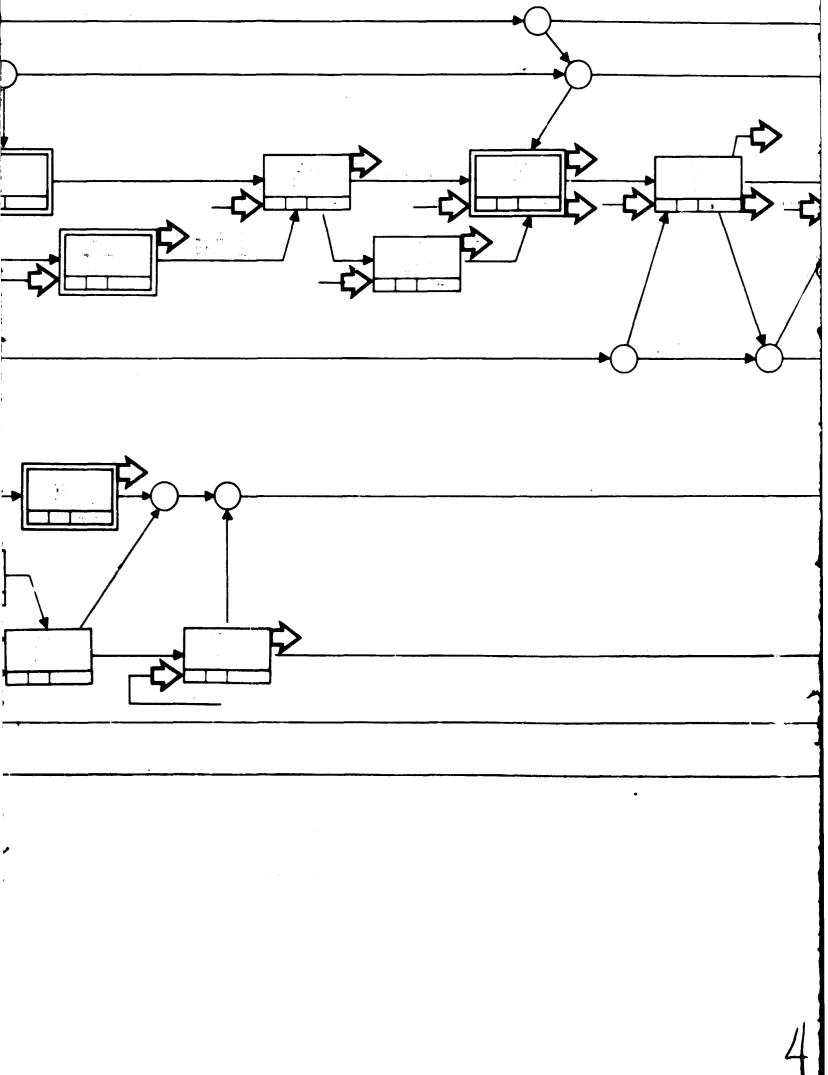
Figure 21. 1.11 Fan and Compressor

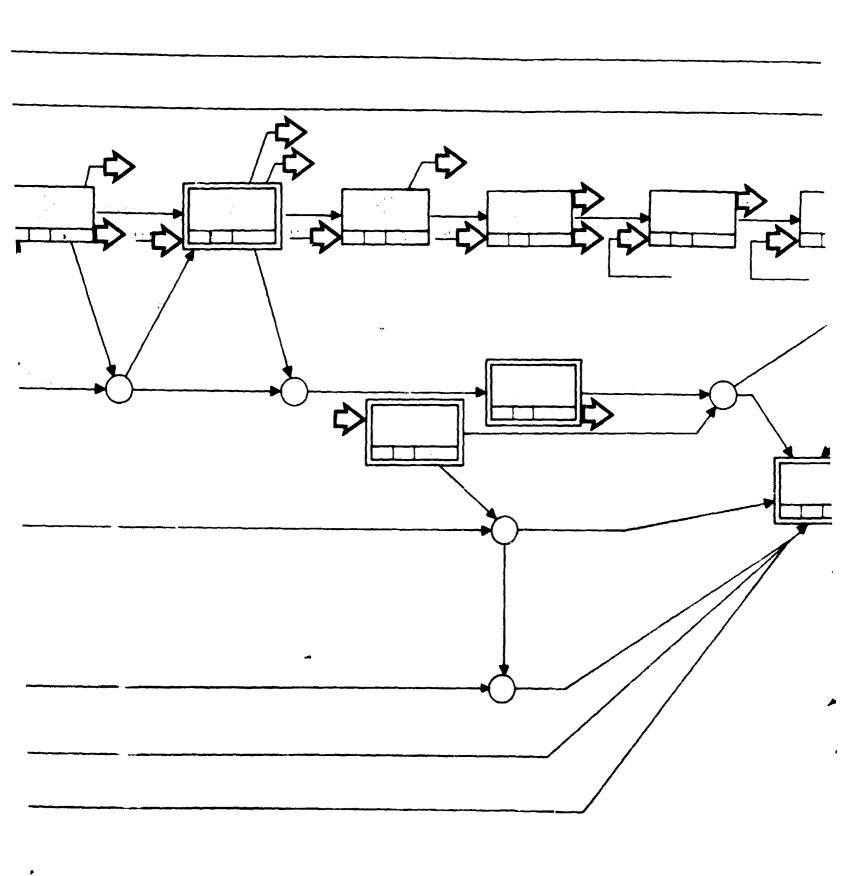


Ä

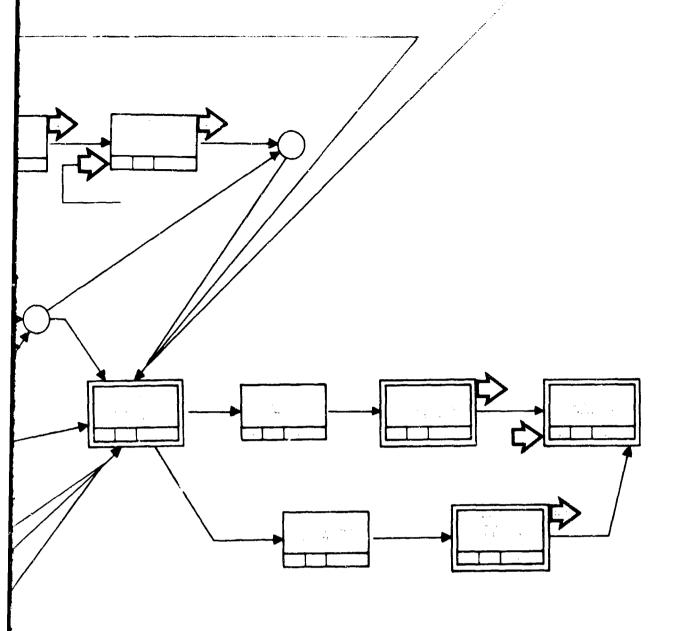








う



1.12 PRIMARY COMBUSTOR

Development of the primary combustor is assisted by early testing of full-scale component rigs for rapid evaluation of configuration changes and design developments to supplement the engine test program. This results in a "weeding" process whereby only configurations with the greatest potential are incorporated into the engine system for continued testing.

An additional full-scale 120-degree segment rig will be fabricated during Phase III and a 30-degree segment rig will be transferred from a related program to supplement the rigs available from Phase II-C.

The component test rigs for this program include a full-scale annular combustor, a 30-degree segment combustor, two full-scale 120-degree segment combustors, and a two-dimensional water table. In addition, primary combustor data will also be obtained from the combined turbine primary combustor development program in the full-scale high spool turbine rig. Supplementary testing for fuel nozzle development and manifold flow distribution will also be accomplished to support the combustor program. The fuel nozzles will be tested on a flow calibration bench prior to their use in the combustor. Manifold flow distribution tests will be conducted on a flow calibration bench to evaluate configurations for engine test.

The full-scale annular primary combustor rig consists of a JT4 engine with the primary combustor section adapted to incorporate the diffuser and the inner and outer primary wall contours of the JTF17 engine. The rig will be used to evaluate configurations which have already indicated high performance potential in the 30-degree and 120-degree segment rigs. The full-scale annular rig sea level test program will be directed toward the following:

- 1. Development of satisfactory discharge temperature patterns
- 2. Development to achieve the required combustion efficiency through the engine range of temperature rise conditions
- 3. Development of satisfactory ignition characteristics
- 4. Durability development at pressure levels equal to SLTO
- J. Evaluation of discharge temperature profile and durability to design modifications.

The annular primary combustor testing for the FTS and certification engine configurations will be accomplished on JTF17 engine test programs with support from the segment rigs for rapid evaluation of configuration changes. Sea level durability, altitude performance, and altitude ignition characteristics will be a part of the primary combustor development program on the prototype engine.

PWA FP 66-100 Volume V

The 30-degree segment and both of the 120-desgree segment rigs will be subjected to tests to evaluate the following:

- 1. Combustor discharge temperature prefile in the intermediate pressure range of engine operation
- 2. Combustor front end fuel/air ratio effects
- 3. Environmental temperature effects on fuel nozzle performance
- 4. Development of the ignition source location and evaluation of ignition schemes with respect to relight capability
- 5. Combustor liner wall temperature measurement to assist in development of combustor durability
- 6. Ignition and durability characteristics over the altitude operating range.

Fuel nozzle bench testing for the primary combustor will encompass the evaluation of spray pattern, spray angle, and flow calibrations involving the determination of hysteresis characteristics and repeatability.

The major milestones, network chart and event dictionary for the primary combustor are shown in figures 23 and 24, respectively.

A detailed description of the primary combustor development is presented in the Test and Certification Plan, Volume III, Report E, and test planning and integration is presented in Test, Volume IV, Report E.

Pratt & Whitney Aircraft PWA FP 66-100 Volume V

FD 17370 VH

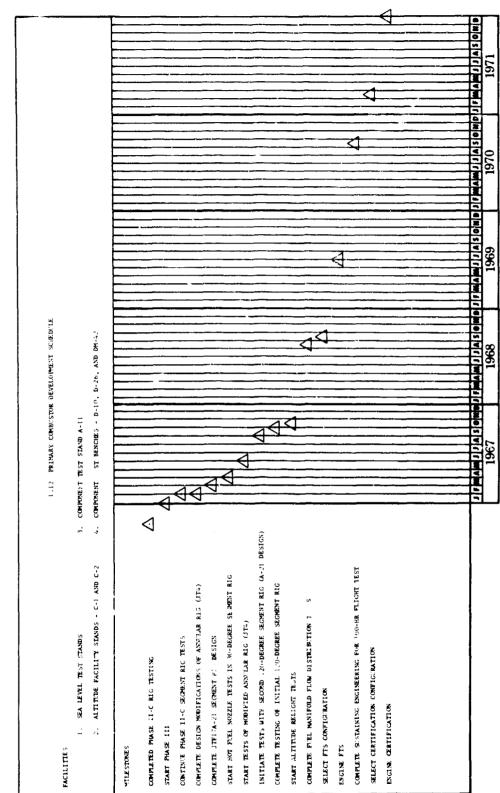
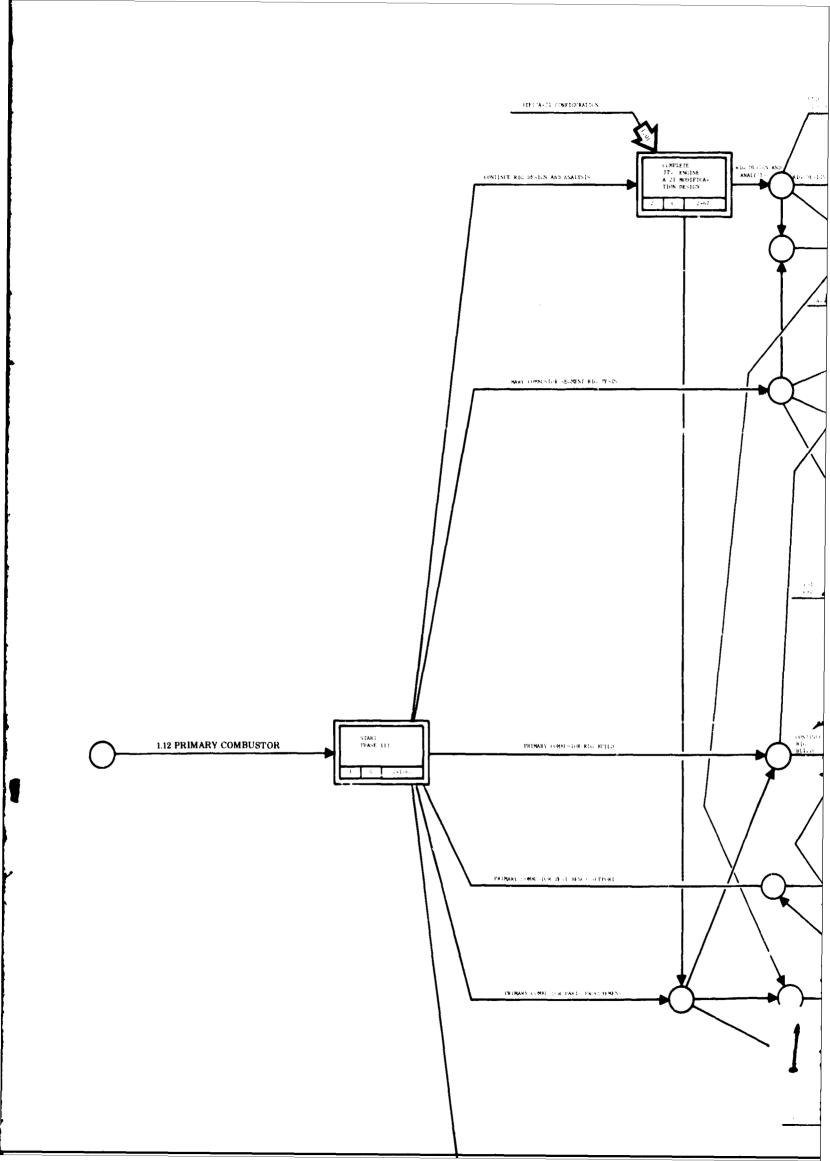
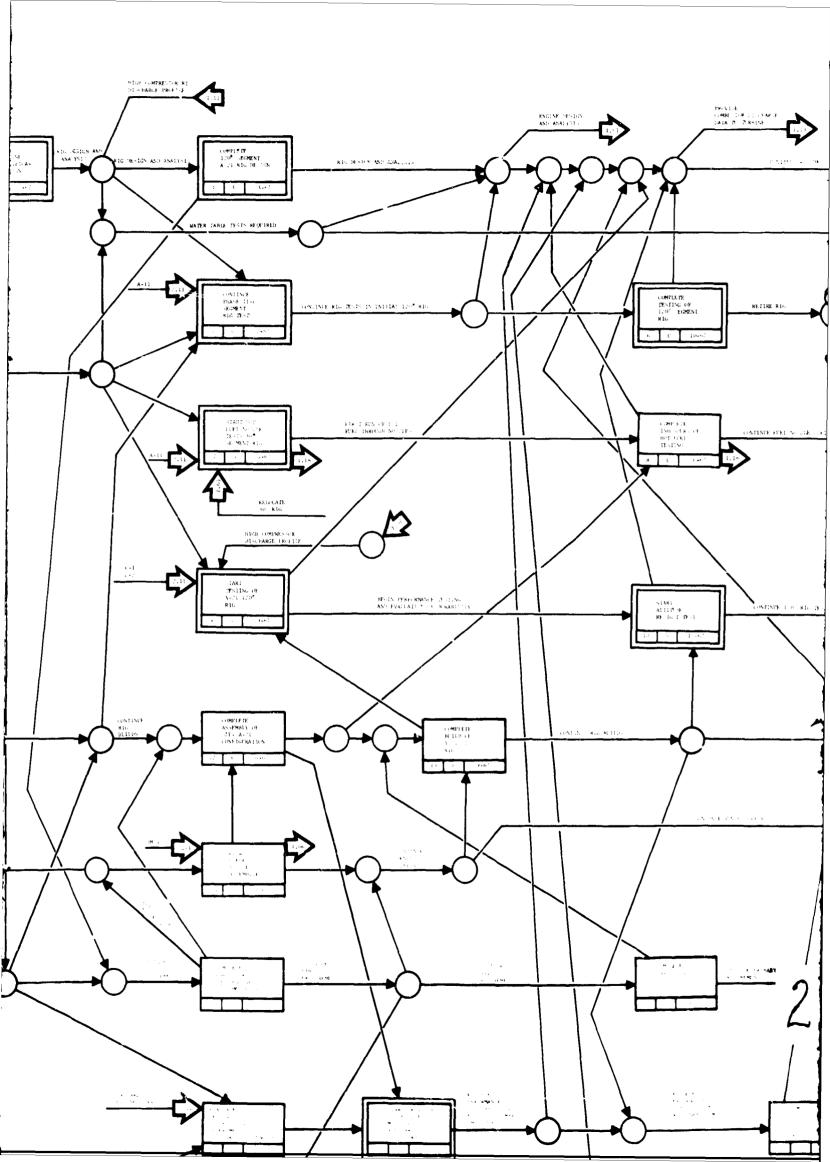
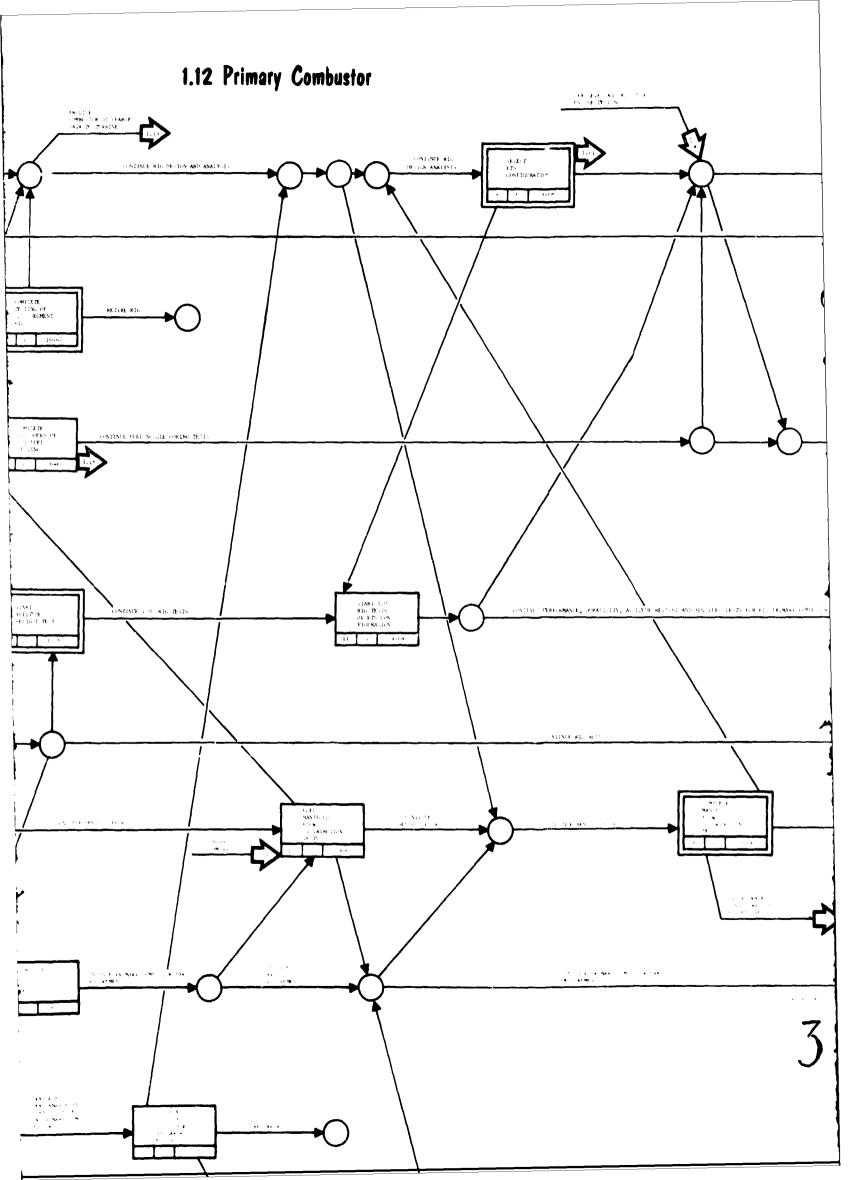


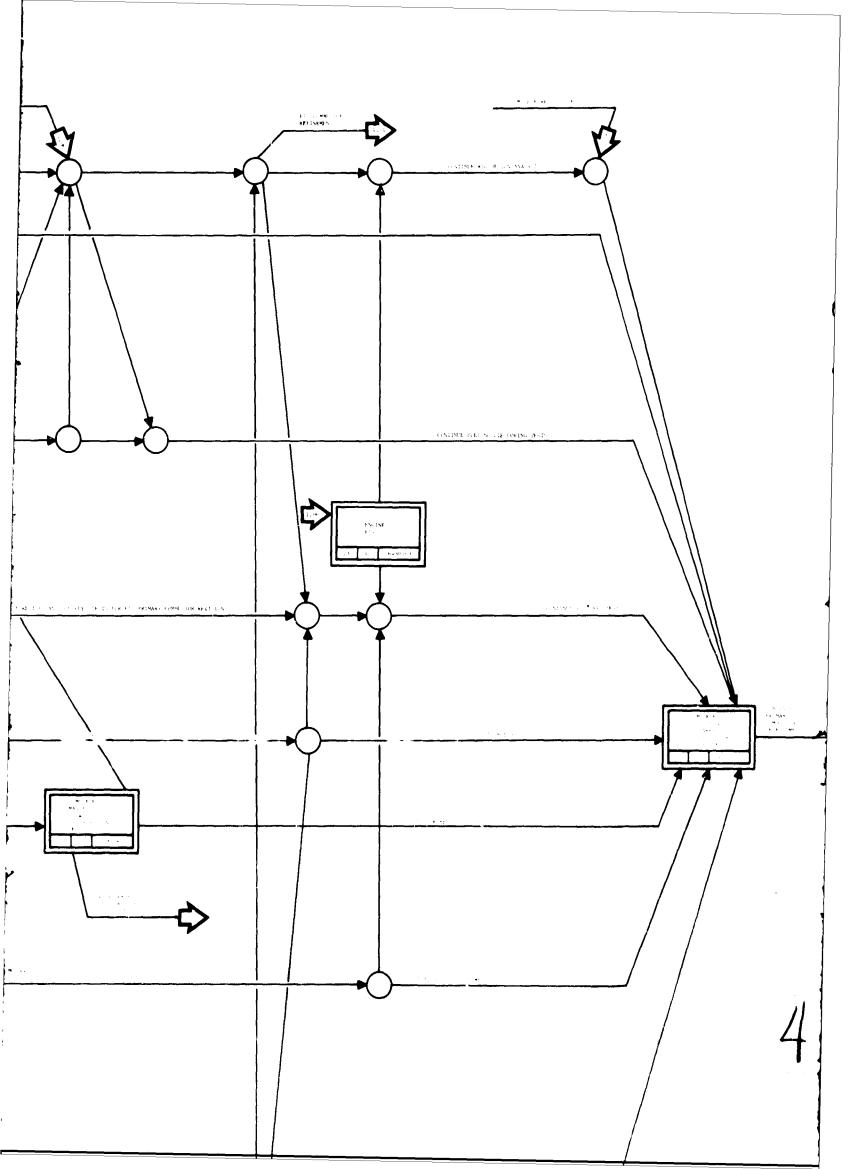
Figure 23. 1.12 Primary Combustor

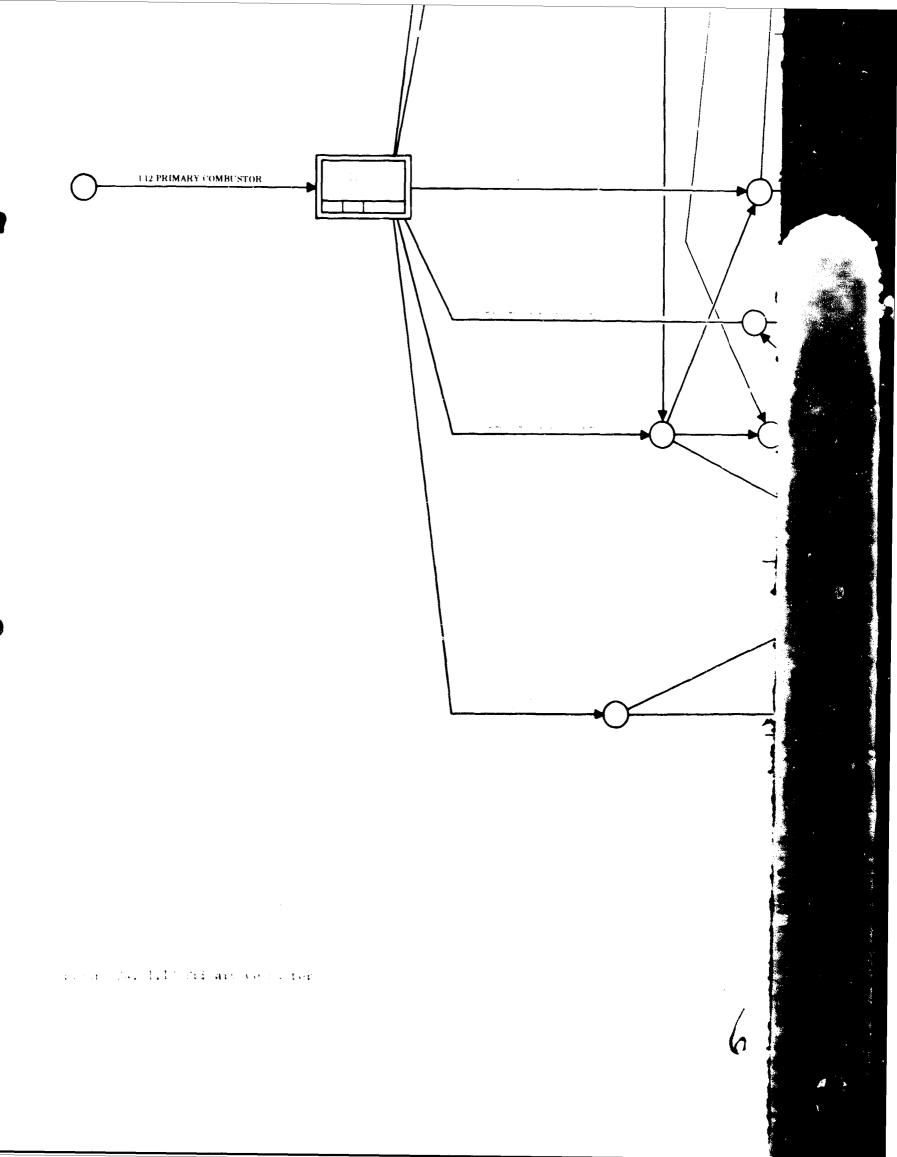
; ;

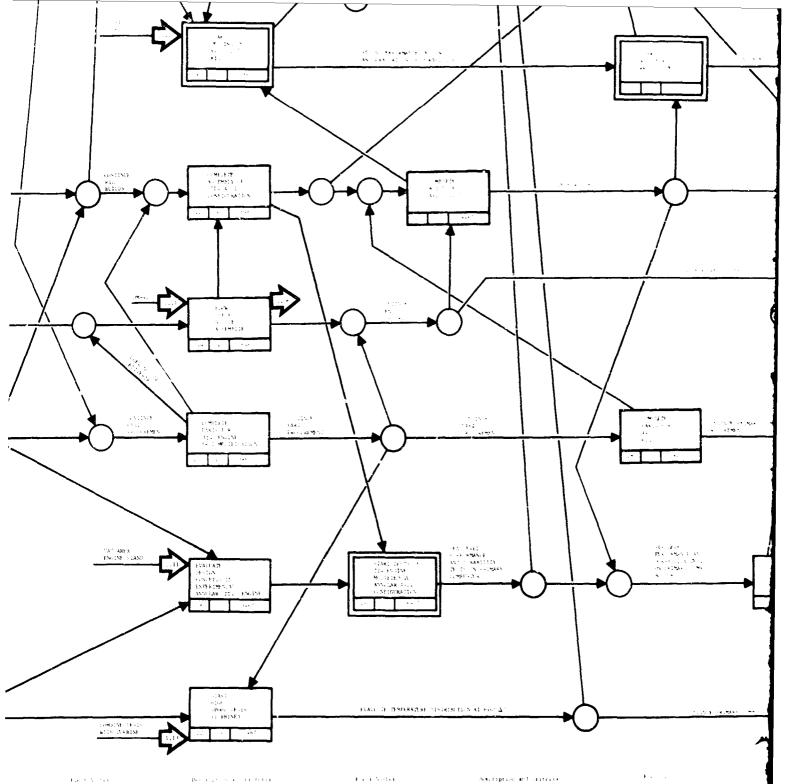








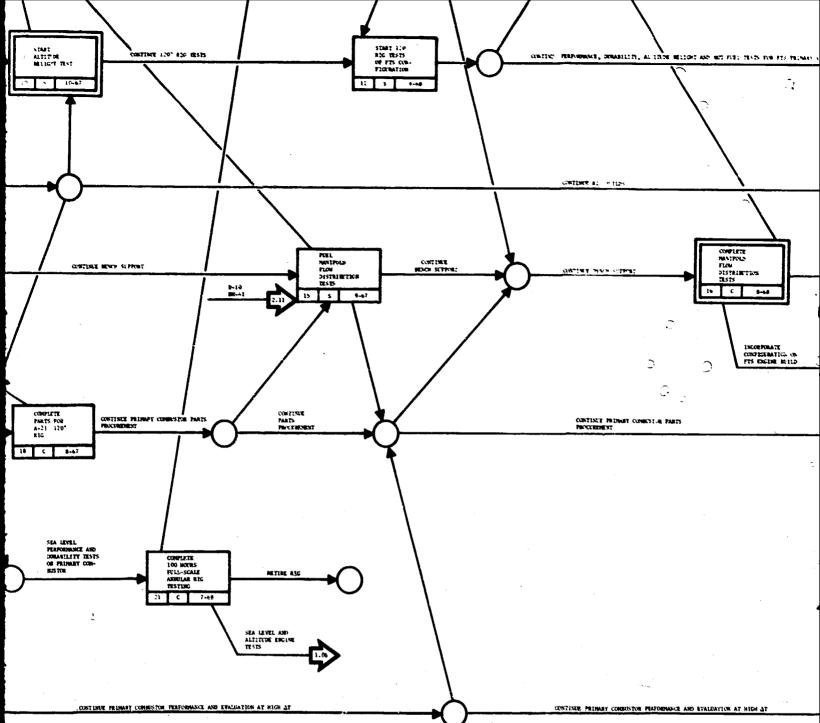




Factor North Co.	Dec. Copt. Science Little Control	Fig. C North 3	Actipites not exitoris	
	$\begin{split} & \left(\frac{\partial x}{\partial x} - \frac{P_{1}(x)P_{1}}{P_{1}(x)} \right) \\ & = \frac{1}{2} \left(\frac{\partial x}{\partial x} + \frac{\partial x}{\partial x} \right) + \frac{\partial x}{\partial x} \\ & = \frac{1}{2} \left(\frac{\partial x}{\partial x} + \frac{\partial x}{\partial x} \right) + \frac{\partial x}{\partial x} \\ & = \frac{1}{2} \left(\frac{\partial x}{\partial x} + \frac{\partial x}{\partial x} \right) + \frac{\partial x}{\partial x} \\ & = \frac{1}{2} \left(\frac{\partial x}{\partial x} + \frac{\partial x}{\partial x} \right) + \frac{\partial x}{\partial x} \\ & = \frac{1}{2} \left(\frac{\partial x}{\partial x} + \frac{\partial x}{\partial x} \right) + \frac{\partial x}{\partial x} \\ & = \frac{1}{2} \left(\frac{\partial x}{\partial x} + \frac{\partial x}{\partial x} \right) + \frac{\partial x}{\partial x} \\ & = \frac{1}{2} \left(\frac{\partial x}{\partial x} + \frac{\partial x}{\partial x} \right) + \frac{\partial x}{\partial x} \\ & = \frac{1}{2} \left(\frac{\partial x}{\partial x} + \frac{\partial x}{\partial x} \right) + \frac{\partial x}{\partial x} \\ & = \frac{1}{2} \left(\frac{\partial x}{\partial x} + \frac{\partial x}{\partial x} \right) + \frac{\partial x}{\partial x} \\ & = \frac{1}{2} \left(\frac{\partial x}{\partial x} + \frac{\partial x}{\partial x} \right) + \frac{\partial x}{\partial x} \\ & = \frac{1}{2} \left(\frac{\partial x}{\partial x} + \frac{\partial x}{\partial x} \right) + \frac{\partial x}{\partial x} \\ & = \frac{1}{2} \left(\frac{\partial x}{\partial x} + \frac{\partial x}{\partial x} \right) + \frac{\partial x}{\partial x} \\ & = \frac{1}{2} \left(\frac{\partial x}{\partial x} + \frac{\partial x}{\partial x} \right) + \frac{\partial x}{\partial x} \\ & = \frac{1}{2} \left(\frac{\partial x}{\partial x} + \frac{\partial x}{\partial x} \right) + \frac{\partial x}{\partial x} \\ & = \frac{1}{2} \left(\frac{\partial x}{\partial x} + \frac{\partial x}{\partial x} \right) + \frac{\partial x}{\partial x} \\ & = \frac{1}{2} \left(\frac{\partial x}{\partial x} + \frac{\partial x}{\partial x} \right) + \frac{\partial x}{\partial x} \\ & = \frac{1}{2} \left(\frac{\partial x}{\partial x} + \frac{\partial x}{\partial x} \right) + \frac{\partial x}{\partial x} \\ & = \frac{1}{2} \left(\frac{\partial x}{\partial x} + \frac{\partial x}{\partial x} \right) + \frac{\partial x}{\partial x} \\ & = \frac{1}{2} \left(\frac{\partial x}{\partial x} + \frac{\partial x}{\partial x} \right) + \frac{\partial x}{\partial x} \\ & = \frac{1}{2} \left(\frac{\partial x}{\partial x} + \frac{\partial x}{\partial x} \right) + \frac{\partial x}{\partial x} \\ & = \frac{1}{2} \left(\frac{\partial x}{\partial x} + \frac{\partial x}{\partial x} \right) + \frac{\partial x}{\partial x} \\ & = \frac{1}{2} \left(\frac{\partial x}{\partial x} + \frac{\partial x}{\partial x} \right) + \frac{\partial x}{\partial x} \\ & = \frac{1}{2} \left(\frac{\partial x}{\partial x} + \frac{\partial x}{\partial x} \right) + \frac{\partial x}{\partial x} \\ & = \frac{1}{2} \left(\frac{\partial x}{\partial x} + \frac{\partial x}{\partial x} \right) + \frac{\partial x}{\partial x} \\ & = \frac{1}{2} \left(\frac{\partial x}{\partial x} + \frac{\partial x}{\partial x} \right) + \frac{\partial x}{\partial x} \\ & = \frac{1}{2} \left(\frac{\partial x}{\partial x} + \frac{\partial x}{\partial x} \right) + \frac{\partial x}{\partial x} \\ & = \frac{1}{2} \left(\frac{\partial x}{\partial x} + \frac{\partial x}{\partial x} \right) + \frac{\partial x}{\partial x} \\ & = \frac{1}{2} \left(\frac{\partial x}{\partial x} + \frac{\partial x}{\partial x} \right) + \frac{\partial x}{\partial x} \\ & = \frac{1}{2} \left(\frac{\partial x}{\partial x} + \frac{\partial x}{\partial x} \right) + \frac{\partial x}{\partial x} \\ & = \frac{1}{2} \left(\frac{\partial x}{\partial x} + \frac{\partial x}{\partial x} \right) + \frac{\partial x}{\partial x} \\ & = \frac{1}{2} \left(\frac{\partial x}{\partial x} + \frac{\partial x}{\partial x} \right) + \frac{\partial x}{\partial x} \\ & = \frac{1}{2} \left(\frac{\partial x}{\partial x} + \frac{\partial x}{\partial x} \right) + \frac{\partial x}{\partial x} \\ & = \frac{1}{2} \left(\frac{\partial x}{\partial x} + \frac{\partial x}{\partial x} \right) + \frac{\partial x}{\partial x} \\ & = \frac{1}{2}$		Control Properties (See Medical Control Contro	. •
	See all applications of the property of the foliation of the above the second of the above the second of the above the second of the second		Elements of Common to Real Elements (RC) More and the Common to C	
	COMPLETE OF BUILDING ACTION OF BUILDING CONTROL OF THE CONTROL OF		· · · · · · · · · · · · · · · · · · ·	
	The second of th		TABLE STATE OF THE STATE OF THE SERVICE METALS AND A SERVICE STATE OF THE SERVICE STATE STATE STATE OF THE SERVICE STATE ST	
	ATEN CALL CONF. (KIETE)			
	the state of the s		completel to the Resident Disc	
	A first in the first term of t			
	the Electrical		STARL OF STORE OF A . OF SEP 1835	VV 1
			have true and the Thomas beat of a	
			Fried that represent the control of the	

7

×. --

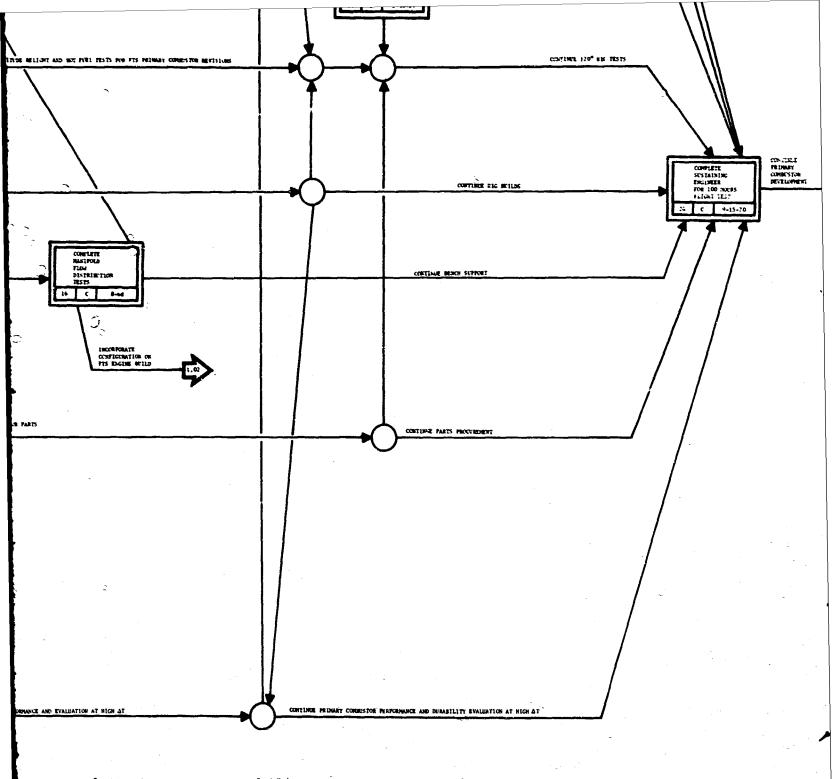


EVENT	BIC	YRAPPIT	
		CONTRACT	

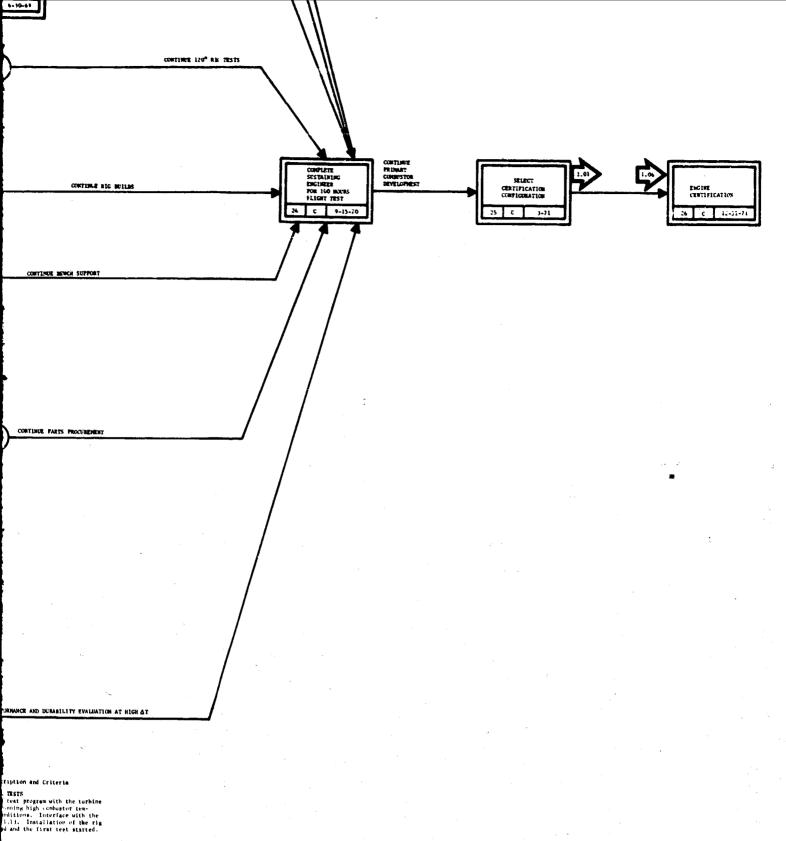
Description and Criteria

(i	START AUTITUDE RELIGHT TEST Begin testing the relight characteristics of the JIFP contestor at all lated littlede conditions on the 200-degree segment tig.	14	FLOW CHECK NOZZIE ASSEMBLIES Frowide test bench support to five check fuel nozzie assemblies for both rigs and engines. The first set of JTT1: fuel nozzie assemblies	. 1 6	COMPLETE PARTS FOR A-21 120-DELREE graft half parts delivered to the build of related to graft and segment combuster rig with JTF17 primary combustor configurations
	START 11 - DEGREE RIC TESTS OF FIS CONFIGURATION Start testing the FTS combustor to the 120-degree angient right of determine since reliaconsta for the FTS engine. The combustor being tested will have incorporated all long-leadstine features for the FTS configuration.	15	will be completed for the medified JT4 ongine. FUEL MANIFULE FLOW DISTRIBUTION TESTS Begin flow bench testing to determine the configuration and orifice requirements to uniformly distribute fuel to the combustor notale and support assembles.	19	EVALUATE DESIGN CONCEPTS IN EXPERIMENT ANDILAR 174 ENGINE Begin testing of basic design concepts JTE17 combinator in the experimental cold the annular JTA origins.
υ	COMPLET ASSEMBLY OF JT- 4-21 CONFIGURATION COMPLETE HE ASSISTANTION of the JT- engine combustion set from to the JTF- configuration. Completion of the JT- engine bould with the JTFI7 configuration annualled. COMPLETE WILLD OF A-21 T2-OPECRETE RIG. COMPLETE WILLD OF A-21 T2-OPECRETE RIG.	i6	COMPLETE MANIFOLD FLOW DISTRIBUTION TESTS Conduct fuel manifold flow distribution test to determine the configuration and ortifice requirements to unaformly distribute fuel to the combustor herzie and support assemblies, Incorporate the configuration in the build of the FTS engine.	20	START TESTS OF JTE ENGINE MODIFIED TO ARRILLAR A-21 COMPIGURATE COMPLETE OF THE COMPLETE OF TH
	arguest rig. The rig will be ready for delivery to lest.	1'	COMPLETE PARTS FOR JPG ENGINE A-21 MODIFICATION All parts delivered for the rebuild of the JT4 angine with the JTF17 primary combinator.		Configuration.

Description and Criteria



Description and Criteria	Event Humber	Description and Criteria
COMPLETE PARTS FOR A-21 120-DECREE RIC All parts delivered to the build of the new 120-degree segment combustor rig with the JTF17 privary combustor configuration. EVALUATE DESIGN CONCEPTS IN EXPERIMENTAL	22	START HIGH SPUGE TESTS hegin a combined test program with the turbine development by running high combistor tem- perature rise conditions. Interface with the turbine metwork 1.13. Installiation of the rig on the test stand and the first test started.
ANNULAR 3T4 ENGINE		
Begin testing of basic design concepts for the JTF12 combustor in the experimental configuration	23	ENGINE FTS
of the annular JT4 engine.		Reference engine network 1.06 for description and criteria.
SYART TESTS OF JT4 EMGINE MODIFIED TO ANNULAR A-21 CONFIGURATION	4	COMPLETE SUSTAINING ENGINEERING FOR 100 HOUR FLIGHT TEST
Sogin tunning the combustof tests on the modified JT4 e	ngine	End of rhame III. Completion of 100 hours of flight testing.
COMPLETE 100 HOUR IULL-SCALE ANSULAR RIG		-
TESTING Complete a total of 100 hours of J14 angles operation while twiting primary combustor contiguration.	28	SELECT CERTIFICATION CONFIGURATION Provide design with information for the primary combustor to be incorporated in the certification engine design. Interface with design networs 1.01 and fabrication network 1.02. The combustor configuration selected will have incorporated all long-lead-time features for the certification engine.
	26	ENGINE CERTIFICATION Reference engine network 1.06 for description and criteria.



network 1.06 for description

SING ENGINEERING FOR 100 HOUR

ATON COMPIGURATION
with information for the primary
incorporated in the certification
interface with design network
ation network 1.07. The combustor
facted will have incorporated
and readures for the certification

ATION | network 1.06 for description

FD 17757 VH

PWA FP 66-100 Volume V

1.13 TURBINE

The JTF17 turbine design is predicated upon continuous operation at high turbine inlet temperatures at cruise, and is an outgrowth of the aircooled turbine developed for the high Mach number J58 engine. The necessity for turbine cooling in the Supersonic Transport engine requires extensive testing of airfoil cooling schemes and their effects on turbine performance. In addition, the requirements for durability, equivalent to current commercial aircraft engines operating at lower turbine inlet temperatures, indicate that extensive testing be done to evaluate thermal fatigue and endurance capabilities of the airfoils.

Resistance to thermal fatigue is an important consideration in the design and development of the JTF17 turbine. Extensive testing was conducted during Phase II-C to evaluate convective cooled and film cooled airfoil schemes for their resistance to thermal fatigue. Cyclic endurance programs conducted in the JT4 turbine development engine (High Spool Rig) indicated that airfoils with interruptions in the stressed walls near the leading edge, such as holes and slots, had virtually no resistance to thermal fatigue. Convectively cooled airfoils tested in the cyclic endurance indicated that mass distribution of the metal across the chord and internal cooling geometry in the airfoil were sensitive parameters in achieving the required thermal fatigue capability.

In continuation of the work done in Phase II-C, the refined airfoil designs in the JTF17 will be evaluated for their resistance to thermal fatigue in the JTF17 high spool rig. Testing will be accomplished by subjecting the parts to alternate periods at maximum turbine inlet temperature and minimum turbine inlet temperature to expose the parts to the most severe thermal fatigue environment anticipated. The lst-stage turbine disk will also be evaluated for thermal gradients in the above mentioned testing program. Another objective which will be accomplished on the full-size high-spool rig is the verification of predicted metal temperatures of the various parts at engine operating conditions. Still another objective of these rig tests will be the verification of design criteria by measuring the vibratory and stress parameters on blades, vanes, disks, and hubs.

The aerodynamic performance of airfoils utilizing cooling airflow in the quantities required for cruise operation can adversely affect overall turbine efficiency. Cooling airflow injection into the mainstream flow has been studied in Phase II-C testing and optimized injection geometry has been established for the JTF17 airfoils. Continued studies of airfoil cooling air injection geometry, effects of platform leakage, and trailing edge discharge characteristics will be conducted in aerodynamic cascade rigs.

Cooling air injection evaluations will be run to optimize the method of admitting and exhausting blade and vane cooling air. This will include an evaluation of the effectiveness of leading edge, pressure side, suction side, trailing edge, and spanwise length discharge configurations. Laminar flow characteristics will also be determined with respect to thermodynamic advantages, surface condition, air exit location and configuration required

Pratt & Whitney Aircraft

PWA FP 66-100 Volume V

to maintain laminar flow. The convective cooling program will include evaluations of multichamber, multipass airfoils, and fabricated airfoils such as wafers and thermal skin.

Cascade programs will also be conducted on vanes and blades to investigate heat transfer, and cyclic fatigue life. These programs will be used as screening tests to aid in the selection of configurations for testing in the full-scale rigs.

Testing will be accomplished on the thermodynamic cascade rigs through Phase III to investigate the thermodynamic characteristics of high efficiency convective cooling schemes. These rigs simulate the necessary entrance and exit conditions to test single blades or vanes under engine environmental conditions.

In addition, testing will be accumulated during the early part of Phase III on a thermal shock rig. Various airfoil configurations based on information from thermodynamic and aerodynamic cascade rig data will be tested to determine (1) transient thermal stresses introduced by various cooling schemes, and (2) cyclic thermal fatigue life of airfoils under consideration for JTF17 engine use.

The major milestones, network chart and event dictionary for the turbine are shown in figures 25 and 26, respectively.

A detailed description of the turbine development is presented in the Test and Certification Plan, Volume III, Report E, and test planning and integration is presented in Test, Volume IV, Report E.

Fratt & Whitney Aircraft PWA FP 66-100 Volume V

MH FD 17871

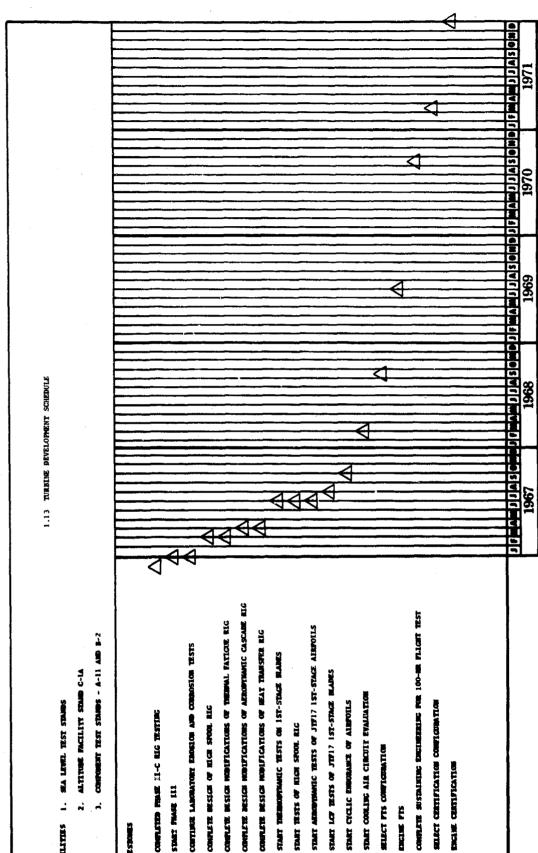
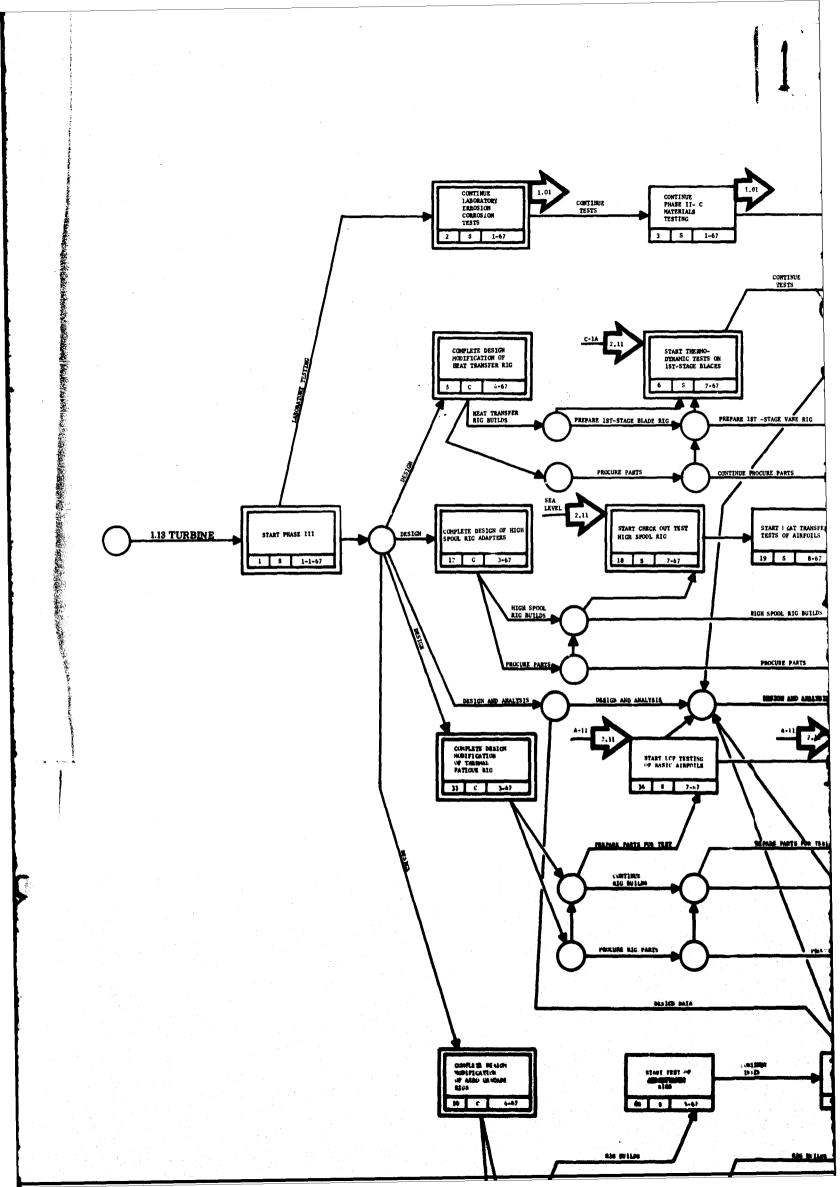


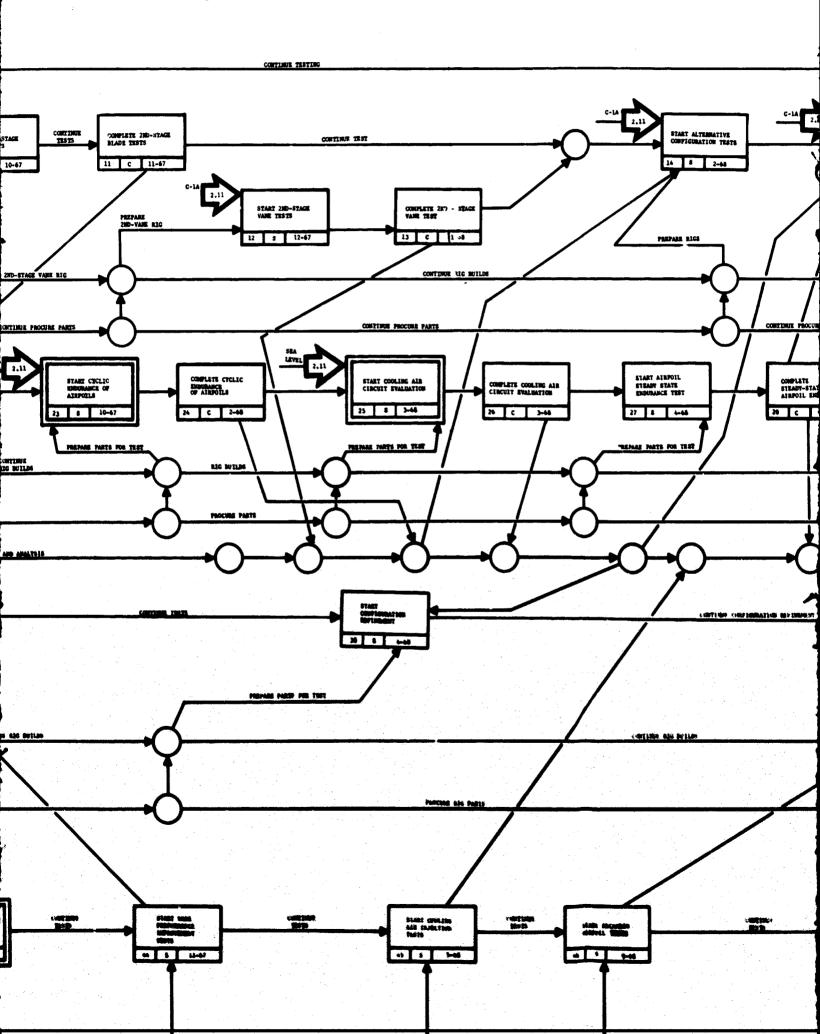
Figure 25. 1.13 Turbine

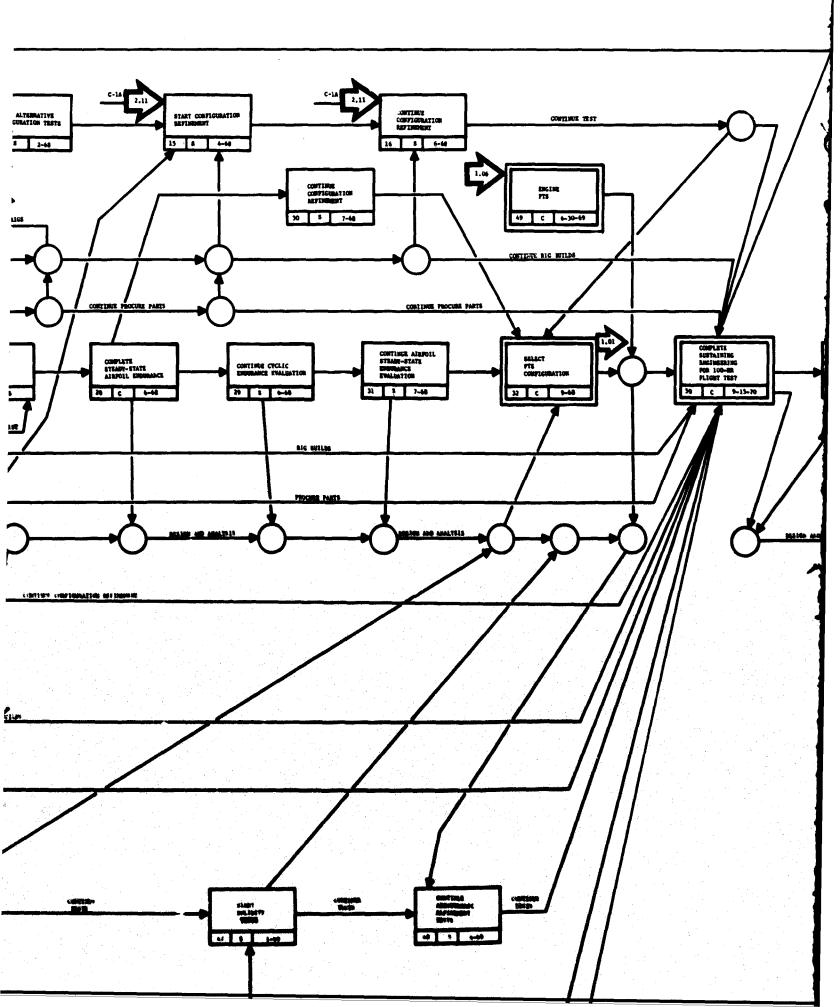
PACILITIES

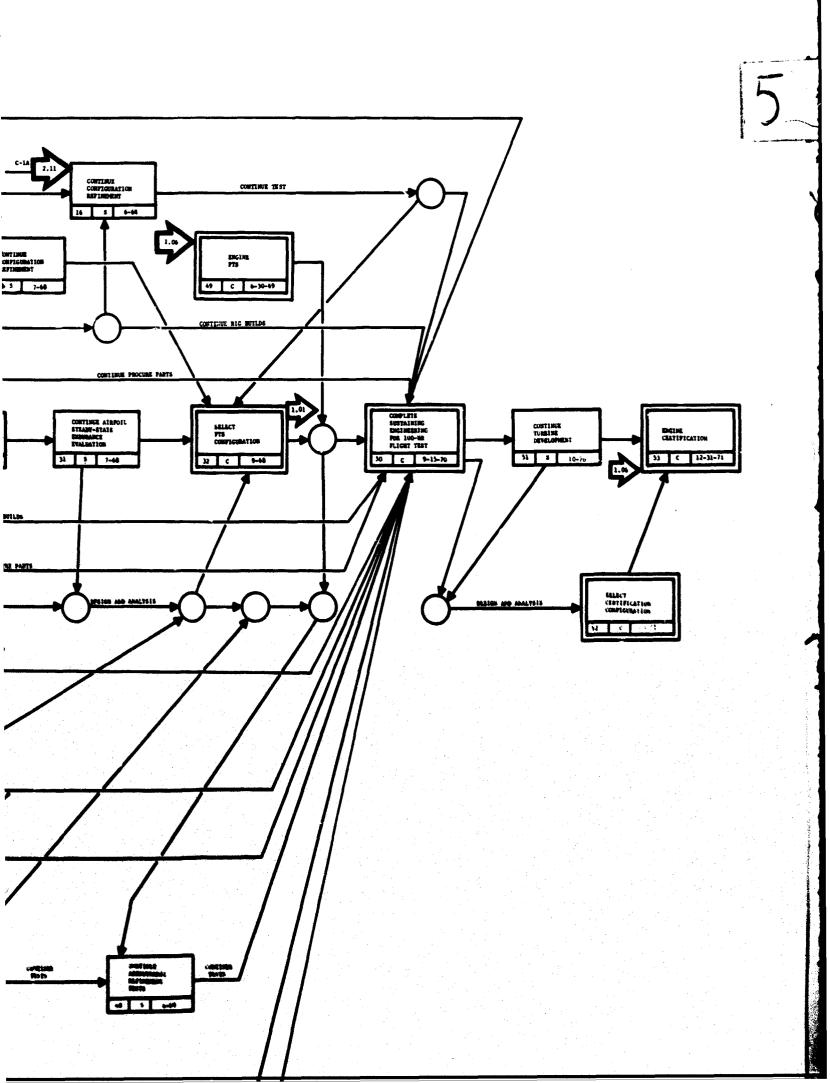
PETE STORES



1.13 Turbine







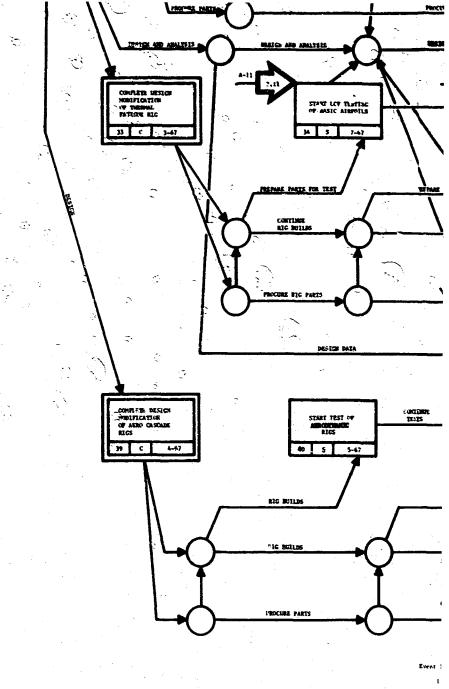
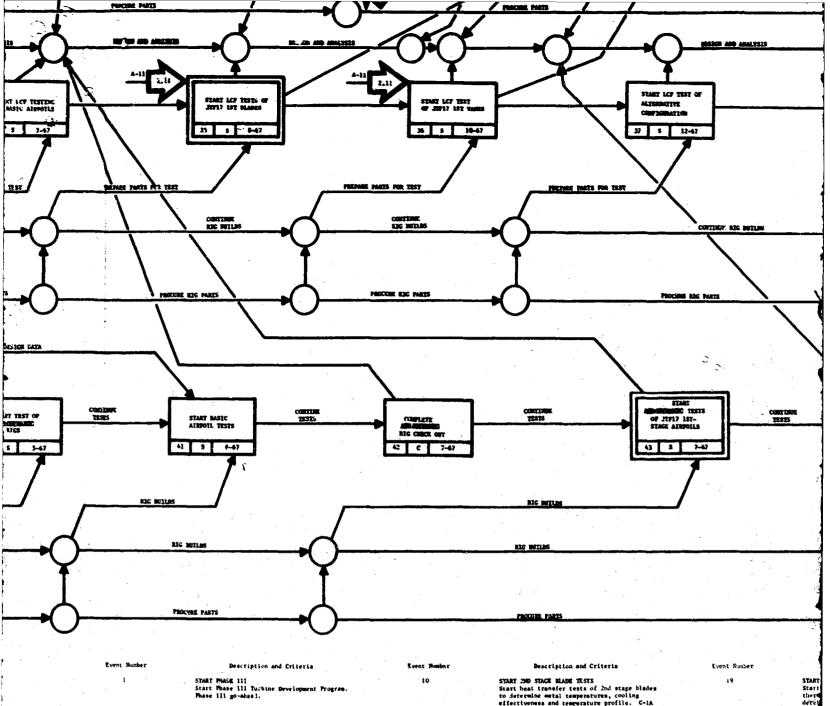
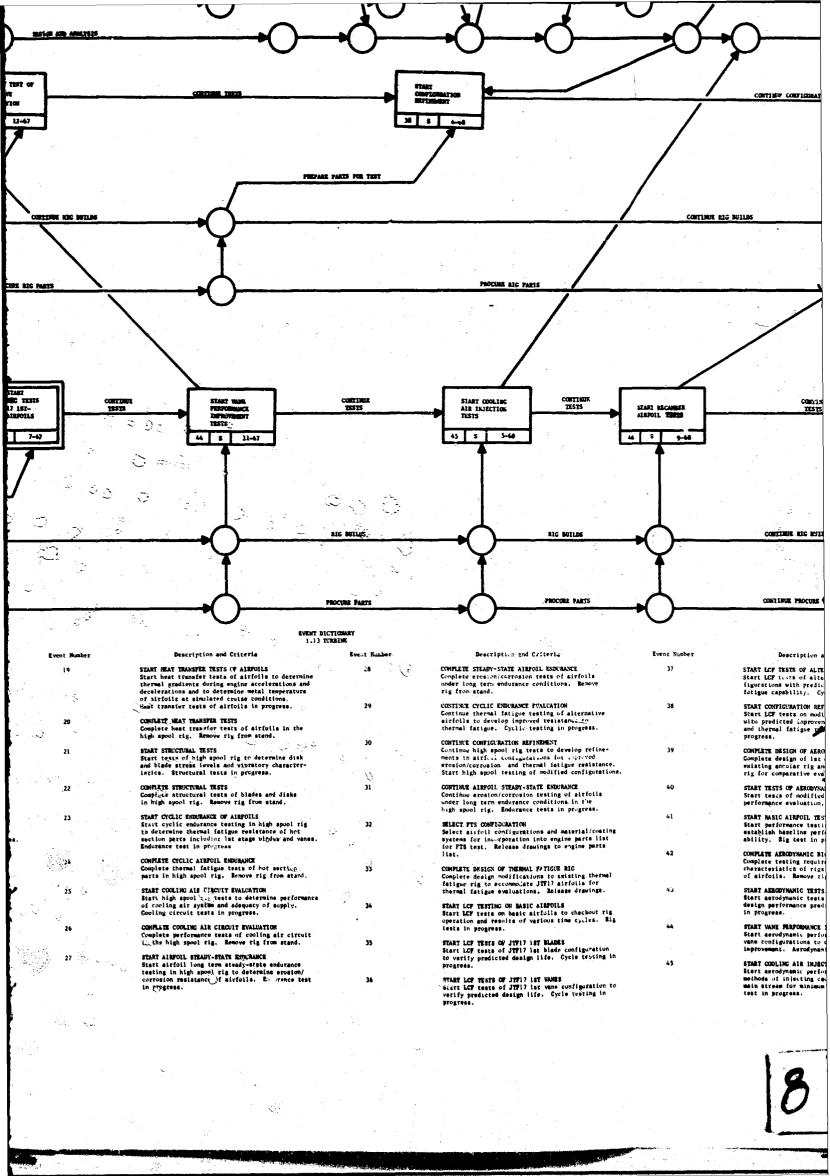
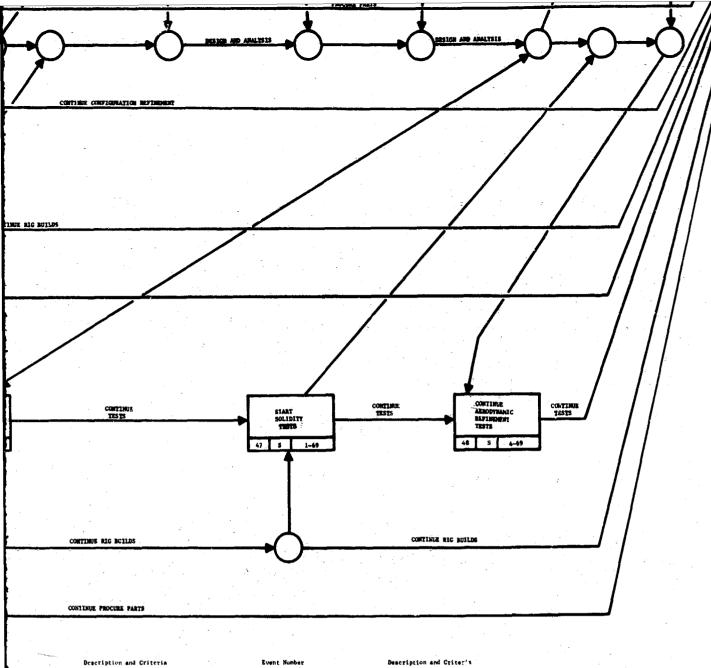


Figure 26. 1.13 Turbine



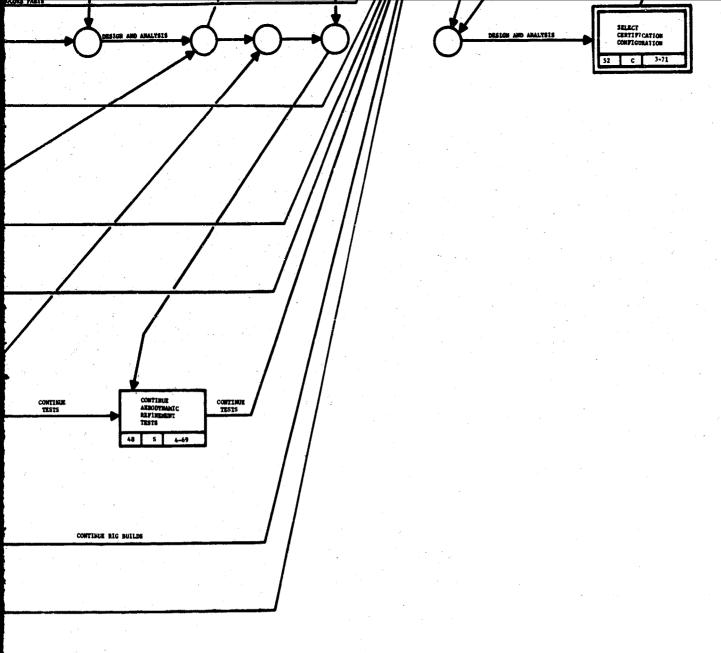
Event Number	Description and Criteria	Svent Humber	Description and Criteria	Event Number	
1	START PHASE III	10	SYART 2ND STACE BLADE TESTS	. 19	STAR
	Start Phase Ill Turbine Development Program.		Start heat transfer tests of 2nd stage blades		Star
•	Phase III go-aheal.		to determine metal temperatures, cooling effectiveness and temperature profile. C-iA		ther dere
7	CONTINUE LABORATORY EROSTON AND CORROSTOR TESTS		stand available. Tests on 2nd blades in progress.		of a
•	Continue Phase II-C isboratory evosion and cor-		stand avertable. Tests on and places in progress.		Seat
	rosion testing of cambidate materials and contings	11	CONTRETE 2ND STAGE BLADE TESTS		wet
	for JIV17 engine. Laboratory tests in progress.	••	Complete heat transfer test of 2nd stage blade	20	CONUE
	date, endaner, menoratory trans at bedrass.		in heat transfer rig. Remove rig from stand,		- C
3	CONTINUE THANK II-C NATERIALS TESTING				hippi
	Continue Phase II-C materials testing of long	12	START 2HD STACE VANE TESTS		
	term creep and stress rupture properties to re-		Start heat transfer testing of 2nd stage vanua	31	STAR
	fine design curves. Laboratory tests in progress.		to determine metal temperature, cooling	and the second second	Star
			affectiveness, and temperature profiles. C-1A		erd .
•	START DISK LCF TESTS		stand available. Tests on 2nd vanes in progress.		int
	Start LCF testing of turbine disks in "Ferris Wheel"				
	LCF rig to verify design life. Tests in "Ferris	13	COMPLETE 200 STAGE VAIN TESTS	22	COMP
	Wheel" cig in progress.		Complete heat transfer test of 2nd stage venes in heat transfer rig. Remove rig from Stand.		Lonp in h
	CONFLETE DESIGN OF HEAT TRANSPER RIG		the state of the s		//
•	Complete design modifications to existing heat	14	START ALTERNATIVE COMPTQUEATION TESTS	Y	STAR
	transfer rigs to accommodate JTF17 airfolis.	•	Start heat transfer tests of alternative con-		Riar
	Bet same drawings to Engineering.		figurations selected as candidates for the JTV17		10.4
			engines. Tests of alternative airfoils in progress.		. TACE
b *	START THERMODYNAMIC TESTS OF 15T STAGE BLADES				Kimu
	Start heat transfer tests of lat stage blades to	15	START CONFIGURATION REFINEMENT TESTS		
	determine mutal temperature, cooling effectiveness		Start heat transfer tests of modified airfoil	24	COMP
	and tomperature profiles. C-lA stand available.		configuration with predicted improvements in		Comp
	Test of lat blade in progress.	•	cooling effectiveness, and temperature profiles.		part
_	The second secon		Testing of andified configurations in progress.		
7	COMPLETE 1ST STACE BLADE WESTS			كاني .	STAR
	Complete hoat transfer test of 1st stage blade	16	CONTINUE CONFIGURATION REFINEMENT		Star
	in heat transfer rig. Remove rig from stand.		Continue testing of modified configurations with predicted improvements in cooling effectiveness,		Cont
•	START 1ST STAGE VANE TESTS		and temperature profiles. Continue testing of		, CON
•	Start heat transfer testing of 1st ctare were	•	modified configurations.	26	COKE
	airfoils to determine motel temperatures, cooling		monttied contributations,	20	Comp
	effectiveness, and temperature profiles. C-1A	. 17	COMPLETE DESIGN OF RIGH SPOOL RIG ABAPTERS		in t
	stand available. Tests of lat vanes in progress	· ••	Complete the design of inlet and exhaust adaptors	and the second second	
		* · · · · · · · · · · · · · · · · · · ·	for the high spool rig, Release drawings to	27	STAR
,	CONVLETE LET STAGE VANGE TESTS		Engineering	•••	Star
	Complete heat transfer test of lat stage vanes	**			test
	in heat transfer rig. Remove rig from stand.	io	START CHECKOUT TESTS OF HIGH SPOOL RIG	•	corr
			Start initial test of high spool rig to establish	1.1	· in p
			operational characteristics and control require-	and the state of t	
			ments for cyclic testing. Initial test of high		1
			apool rig.		





Description and Criteria	Event Number	Description and Criter's
START LCF TESTS OF ALTERNATIVE CONFIGURATIONS Start LCF tests of alternative airfoil con- figurations with predicted improvements in thermal fatigue capability. Cycle testing in progress.	46	START RECAMBER AIRPOIL TESTS Start serodynamic rests to determine performance improvements with recambered airfoils Aerodynamic test in progress.
START CONFIGURATION REFINEMENT Stert LCT tears on modified airfoil configurations with predicted improvements in cooling effectiveness and thermal fatigue resistance. Cycle testing in progress.	47	START SOLIDITY TESTS Start serodynamic tests to determine performance. inprovement with reduced solidity sirfoil arrange- ments. Aerodynamic test in progress.
COMPLETE DESIGN OF AERODYNAMIC CASCADE RIG Complete design of lst stage test section for existing annular rig and design of plane caucade rig for comparative evaluations. Release drawings.	48	CLATTRUE ARROGYMANIC REPIREMENT TESTS Continue acrodynamic tests of atriolis with cooling effectiveness and LCF refinements for improved performance and durability. Aerodynamic test in progress.
START TESTS OF ARROWNAMIC RIGS Start tests of modified annular rig for airful performance evaluation. Rig test in progress.	49	ENGINE FTS Anforence engine network 1.06 for description and critoria.
START BASIC AIRFOIL TESTS Start performance testing of basic airfoils to establish baseline performance for rig and repeat- ability. Rig test in progress.	50	COMPLETE SUSTAINING ENGINEERING FOR 100 MOUR FILCHT TEST Bnd of Phase III. Completion of 100 hours of flight testing.
COMPLETE ARRODYNAMIC RIG CHECKNUT Complete teating required to establish operating characteristics of rigs and baseline performance of sirfoils. Remove rig from stand,	51	CONTINUE TURBINE DEVELOPMENT Continue turbine development testing for per- foreance and durability improvements. Big testing in progress.
START AERCOYNAMIC TESTS OF JTF17 18Y STAGE AIRFOILS Start aerodynamic tests of JTF17 airfoils to verify design performance predictions. Aerodynamic test in progress.	52	SELECT CERTIFICATION CONFIGURATION Belect airfoil designs for certification engine Lith prescribed performance and durability caps* Anities Release airfoil designs to engine parts
START VANE PERFORMANCE INPROVEMENT TESTS Start aerodynamic performance tests of various vane configurations to determine performance improvement. Aerodynamic test in progress.	53	LICINE CERTIFICATION Neference engine network 1.06 for description and criteria.
START COOLING AIR INTECTION TESTS Start serodynamic performance tests to evaluate methods of injecting cooling air into the turbine main stream for minimum loss offects. Aerodynamic test in progress.		





Description and Criteria

START RECAMBER AIRFOIL TESTS
Start serodynamic tests to determine performance
improvements with recambered airfolls Aerodynamic
test in progress.

START SOLIDITY TESTS

Elert aerodynamic tests to determine performance
improvement with reduced solidity airfoil arrangements. Aerodynamic test in progress.

CONTINUE AERODYNAMIC REFIREMENT TESTS
Continue aerodynamic tests of airfolis with
cooling effectiveness and LCD refinements
for improved performance and durability.
Aerodynamic test in progress.

SMGINE FTS Reference engine network 1.06 for description and criteria.

CONPLETE SUSPLINING ENGINEERING FOR 100 NOUR FLIGHT TEST End of Phase III. Completion of 100 hours of flight testing.

CONTINUE TURNING DEVELOPMENT
Continue turbine development testing for performance and durability improvements. Rigtesting in progress.

SELECT CERTIFICATION CONFIGURATION Select sirfoil designs for certification engine with prescribed performance and durability sapabilities. Belease airful designs to ongine parts list.

ENGINE CRATIFICATION Reference engine network 1.06 for description and criteria. 10

FD 17828 VH

1.14 AUGMENTOR

The duct heater component program will center around a full-scale rig which is an identical representation of the duct heater portion of the JTF17 engine and will be supplemented by full-scale testing of two sector rigs; an annular 0.6-scale duct diffuser rig; and a water tunnel rig.

The full-scale annular duct heater rig will be tested in the FRDC altitude facility to determine duct heater combustion efficiencies, pressure drop, operating range, durability, and ignition capabilities of the basic design and various modifications. The program for this rig will be coordinated with ignition system development, and ignition system hardware will be tested throughout the program.

A full-scale sector rig equivalent to a 60-degree segment will be tested as a supplement to the full-annular rig and testing will be initiated during the early part of Phase III. This rig and the existing smaller segment rig will be used to aid in selections of designs and programs for the full-annular rig by investigating duct burner efficiencies, pressure drop operating range, durability, and ignition capabilities of various designs and modifications at reduced effort and cost. The rig consists of a 60-degree segment, which can be easily and quickly changed or modified, and has a relatively small airflow requirement. This method for preliminary evaluation has proved very successful in prior J58 testing.

In addition to the test rigs, fuel nozzle bench calibration testing will be done to support the sector rigs and the full-annular rig. This testing will consist of evaluation of various designs for fuel spray pattern, flow rate, pressure drop, and droplet size.

The major milestones, network chart and event dictionary for the augmentor are shown in figures 27 and 28, respectively.

A detailed description of the augmentor development is presented in the Test and Certification Plan, Volume III, Report E, and test planning and integration is presented in Test, Volume IV, Report E.

Pratt & Whitney Aircraft PWA FP 66-100 Volume V

FD 17872 VH

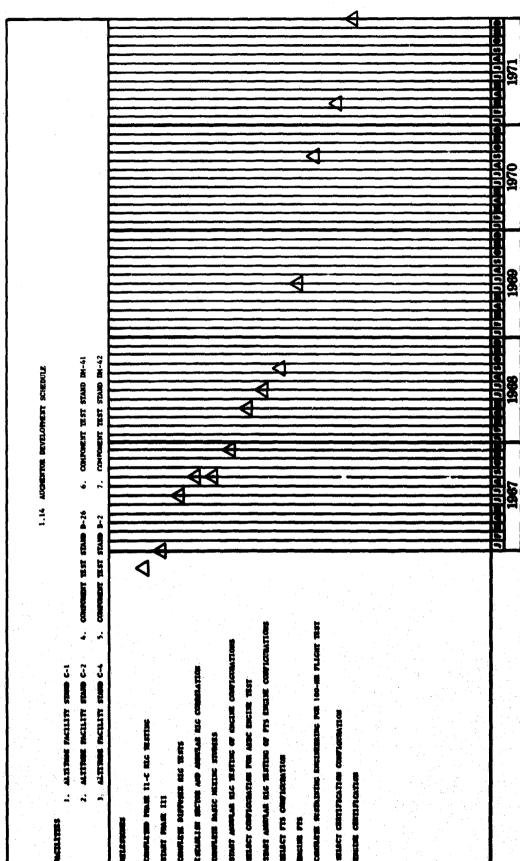
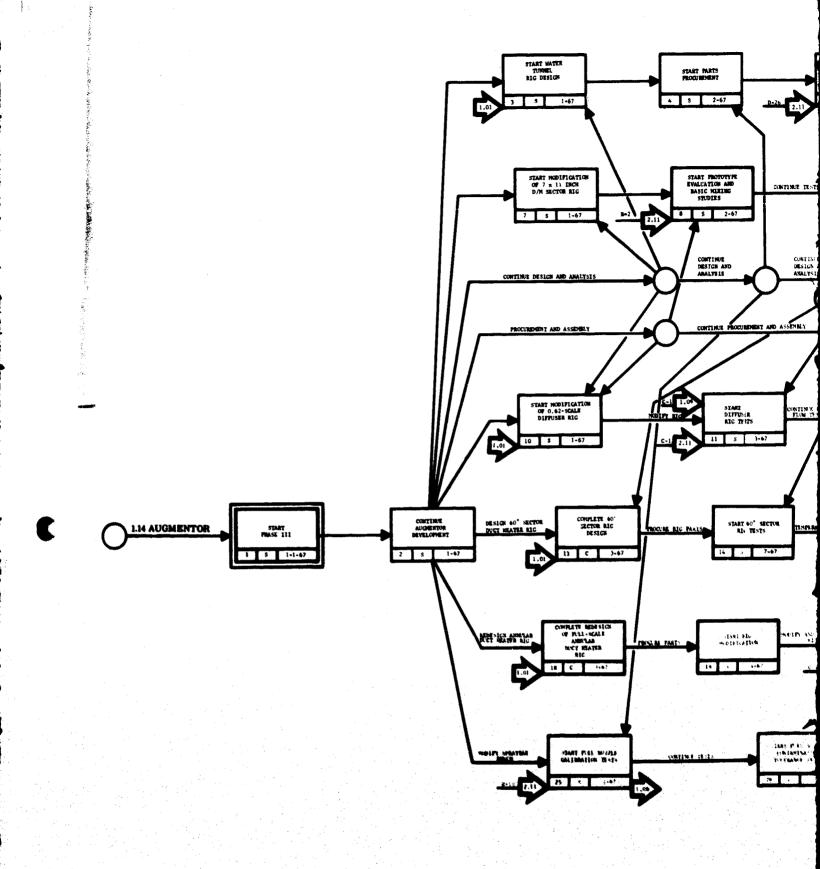
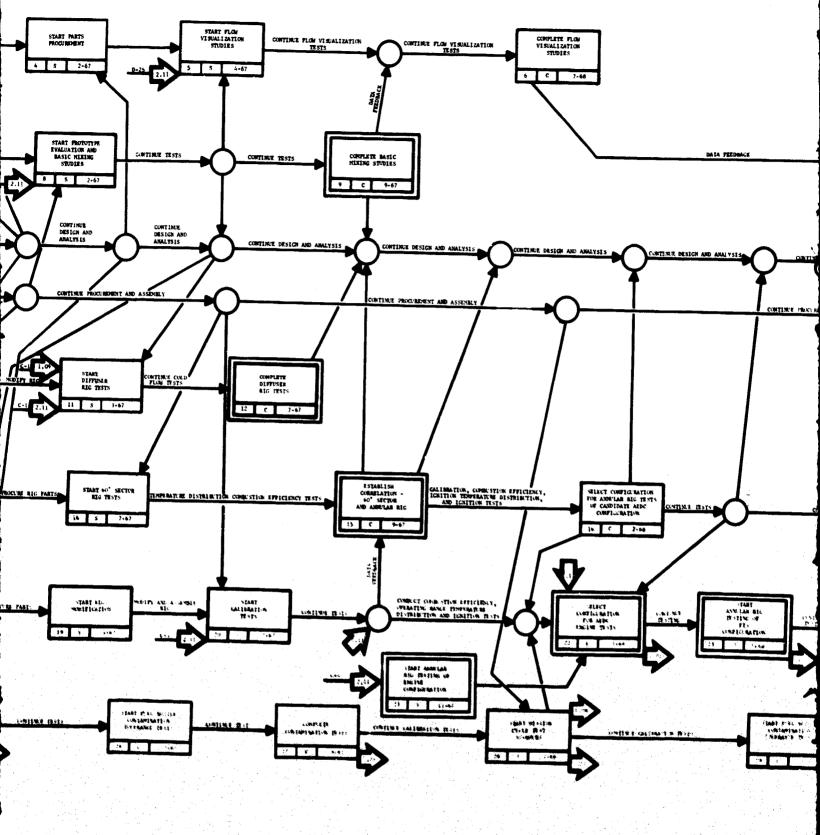


Figure 27. 1.14 Augmentor



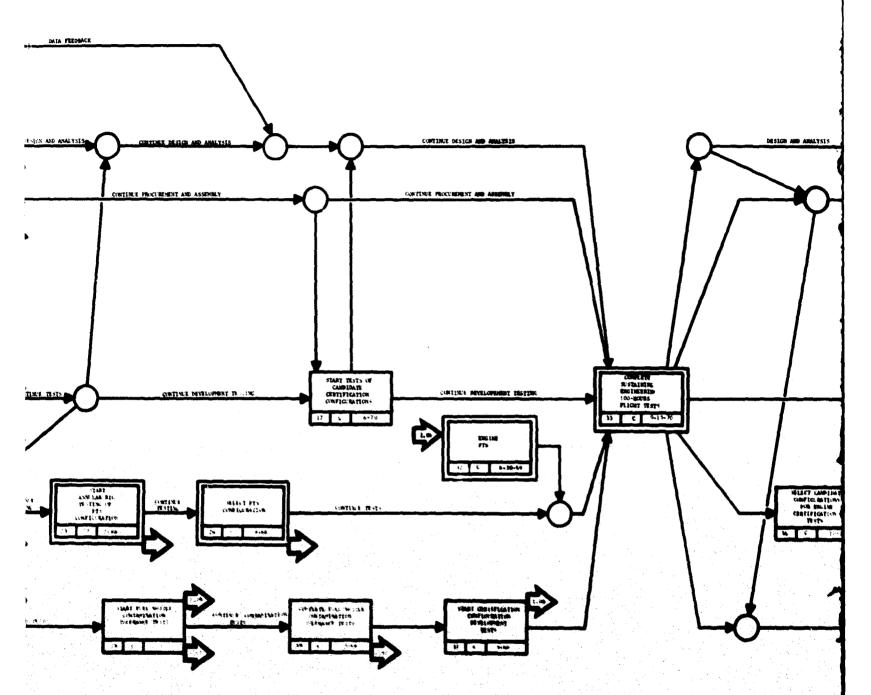
Service of the servic

აგრიდან მიგრი (მარდაგებულ გაურებადა) მენიში — მარცია გრიდანებულ მათა ტათანები — მარება მენიში გრამე დგამათი სამთანა მეგრები მრება მრება (მა. 2018) შენიში მაგრანენითანა ამეგრებულ მასამი



2

1.14 Augmentor-Duct Heater



Countries and course of

and the second of the second o

THE STANDARD AS AS AS AS AS ASSESSMENT OF THE STANDARD ASSESSMENT OF THE ST

Description was increased

and the second of the second o

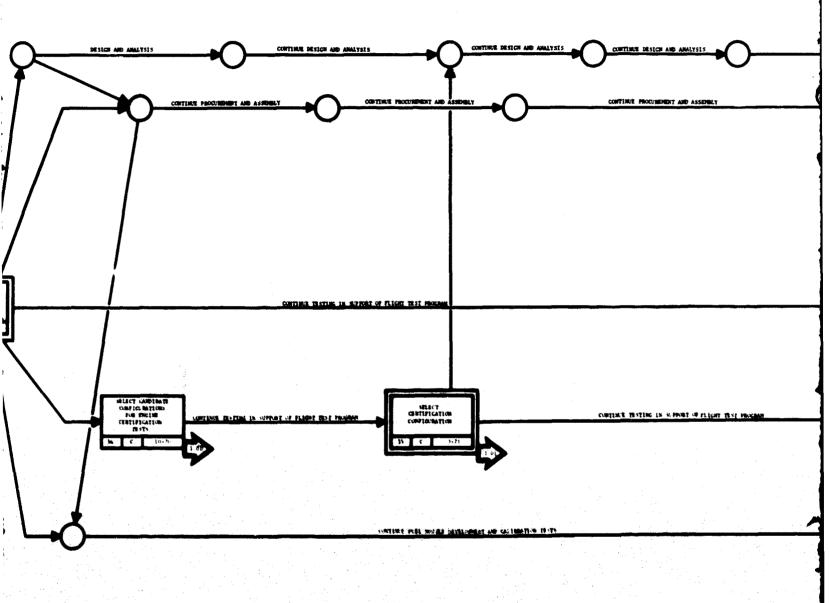
(a) The Market and the second of the seco

ing gap on sometry, and the second of the se

in magnetic programme in the state of the st

Application of the second of th

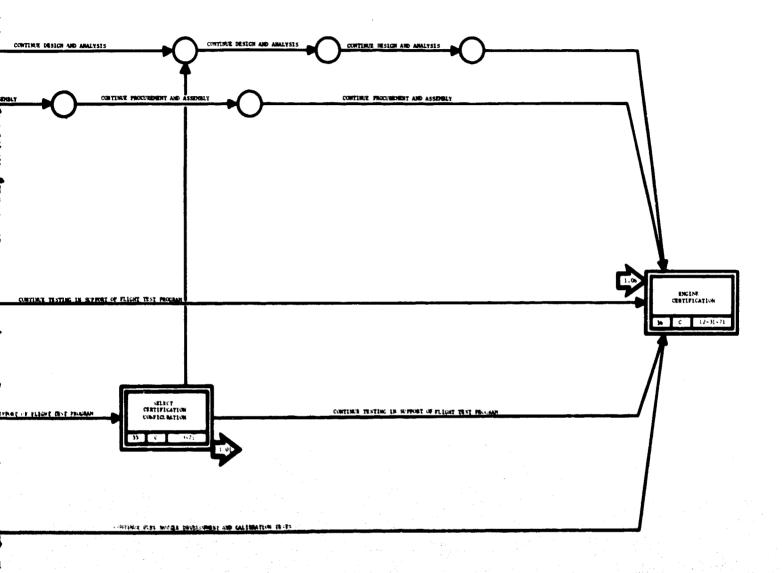
3



Maria de la Maria de Astronomia de Carta de Cart The state of the s ate (where \$ 10 years with a newweek 10 \$ 10 years only 10 \$ 10 years of \$ 10 years only 10 \$ 10 years only 10 \$ 10 years only 10 \$ 10 years on the second of the second The second secon

The property of the control of the c Applied to the second s

glaghtensin um inches in



Brackstand Brackstand State (1994)

10. (1994) State (199

1.15 EXHAUST SYSTEM

North Company of the Section of the

Rig and laboratory testing will include load deflection and cyclic testing of all critical portions of the reverser-suppressor. These tests will be conducted on segments of the reverser-suppressor and will encompass structural support members; inner and outer structural skin sections; reverser clamshell structure, pivot points and linkage; exit flap (tail-feathers) structure, seals, hinges and support members; tertiary air doors and reverser door units; secondary air seals and engine attachment members.

The initial objective of the rig and laboratory testing will be to produce failures so that design improvements can be incorporated in subsequent engine hardware. The final objective will be to demonstrate the adequacy of these improvements before engine endurance and certification testing begins.

Model testing will be continued, in support of the above hardware testing, to explore means of further improving ejector and reverser performance and achieve increased noise suppression ability.

Performance models will be tested in the United Aircraft Corporation Research Laboratories wind tunnel facilities.

Integration of the exhaust system with the aircraft is a vital consideration in achieving overall performance levels. Experience has shown that installation effects on internal ejector performance are most significant in the transonic flight region when the tertiary air doors are open. At cruise conditions when the tertiary air doors are closed, the internal ejector performance is virtually insensitive to the aircraft local flow field. However, the external performance, such as nacelle drag, is always affected by aircraft flow field, especially if the exhaust system is canted relative to the remainder of the nacelle. For these reasons the scale model testing at United Aircraft Corporation Research Laboratories will include reverser-suppressor installation performance testing to evaluate these effects.

Noise suppression models will be tested in the FRDC jet noise test stand, and results from this testing will be used to establish the full-scale program. Full-scale engine noise suppression work will be done in conjunction with reverser development testing on a JTF17 engine test stand.

The major milestones, network chart and event dictionary for the exhaust system are shown in figures 29 and 30, respectively.

A detailed description of the exhaust system development is presented in the Test and Certification Plan, Volume III, Report E, and test planning and integration is presented in Test, Volume IV, Report E.

Pratt & Whitney Aircraft PWA FP 66-100 Volume V

FD 17873 VH

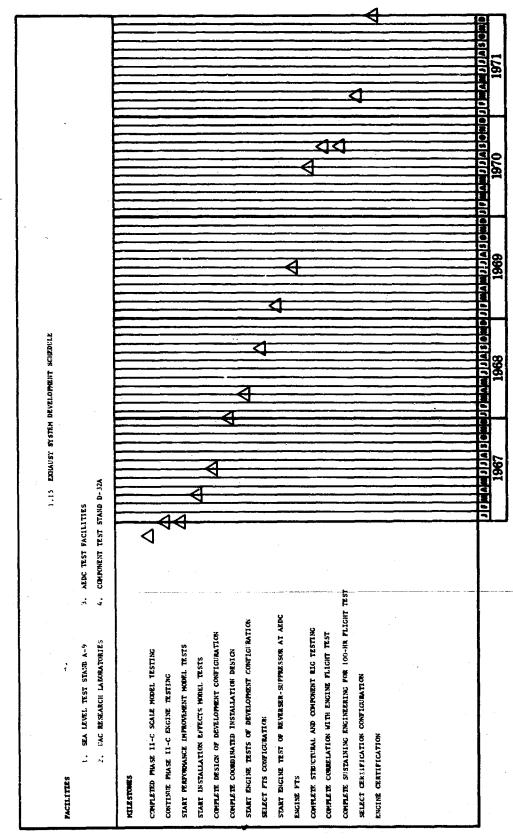
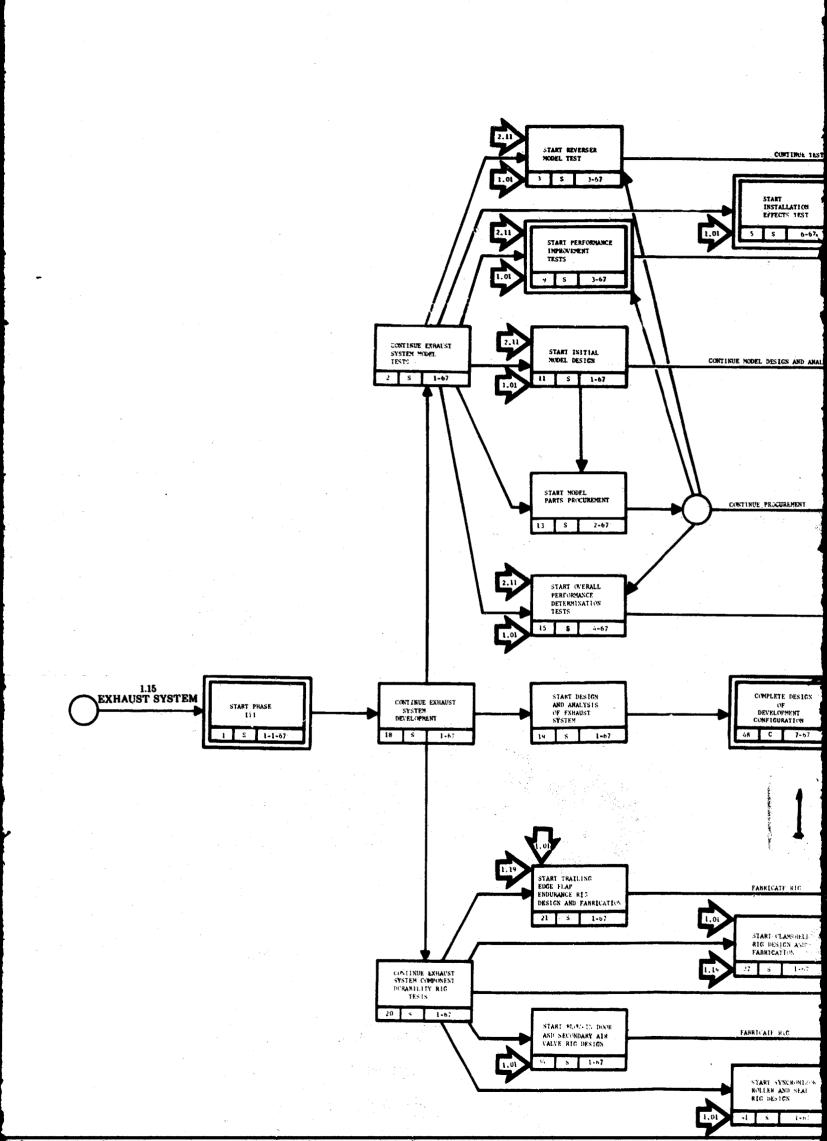
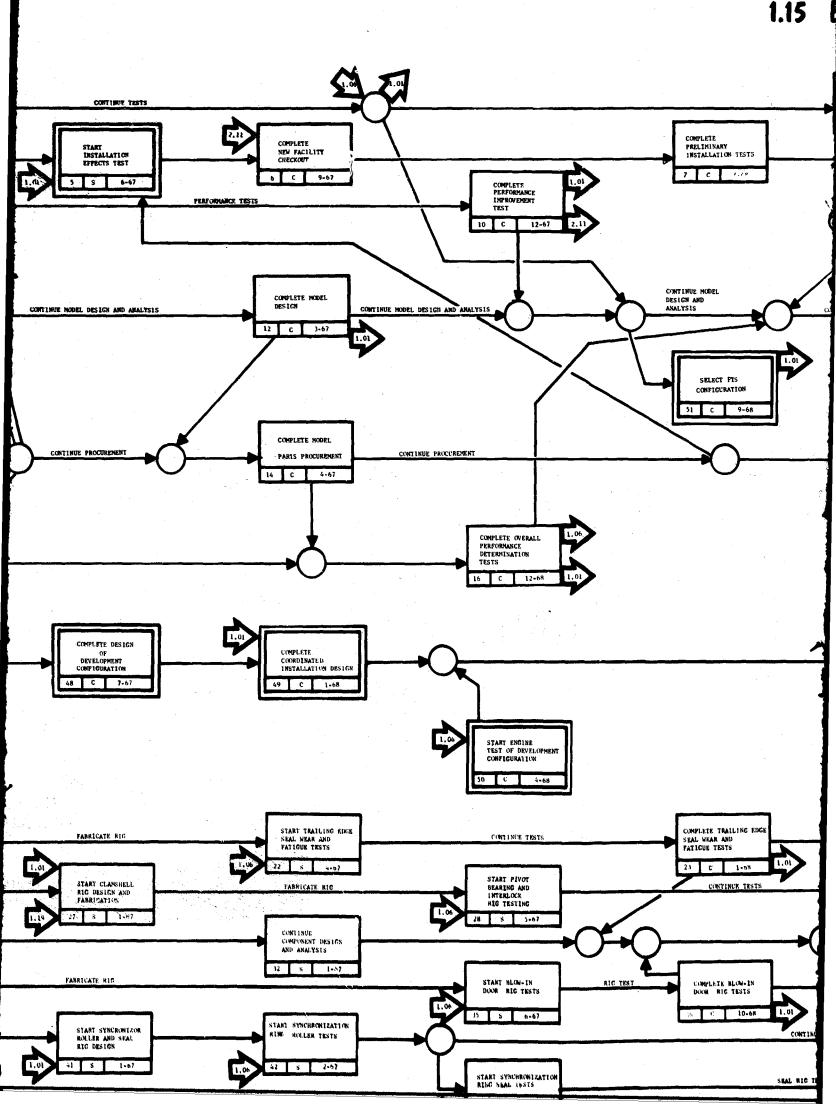
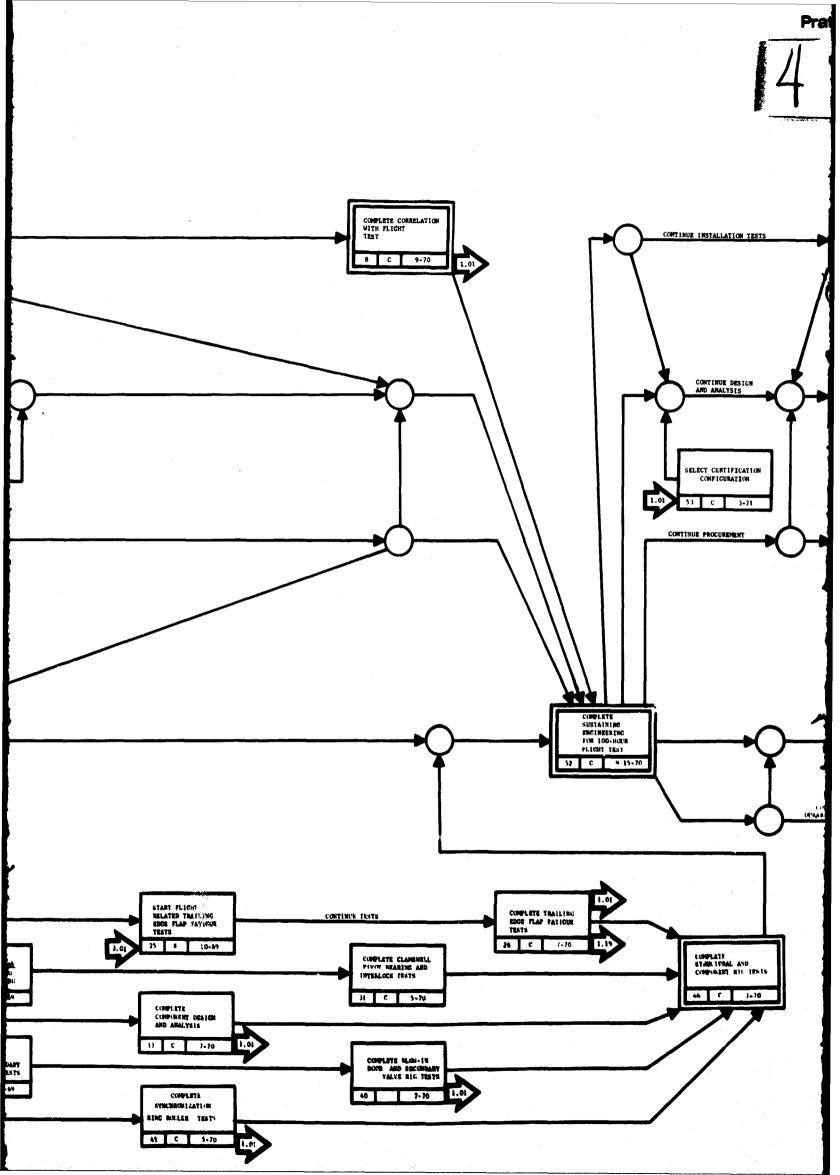
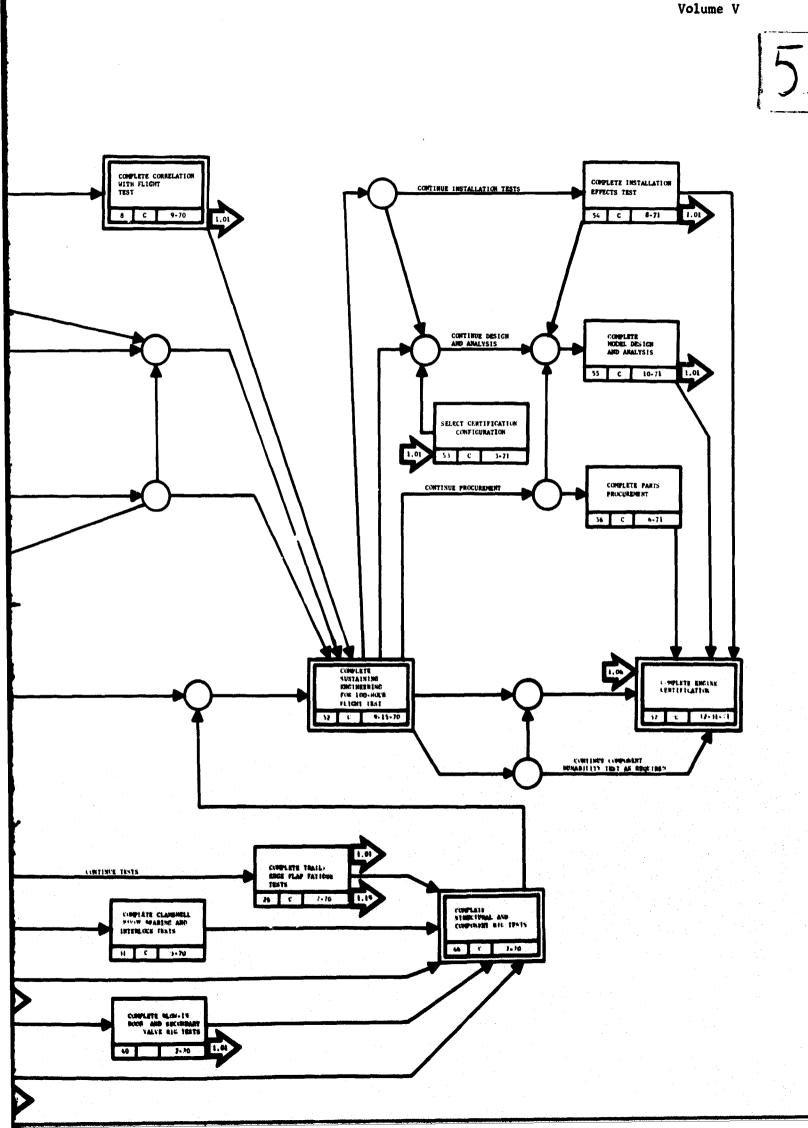


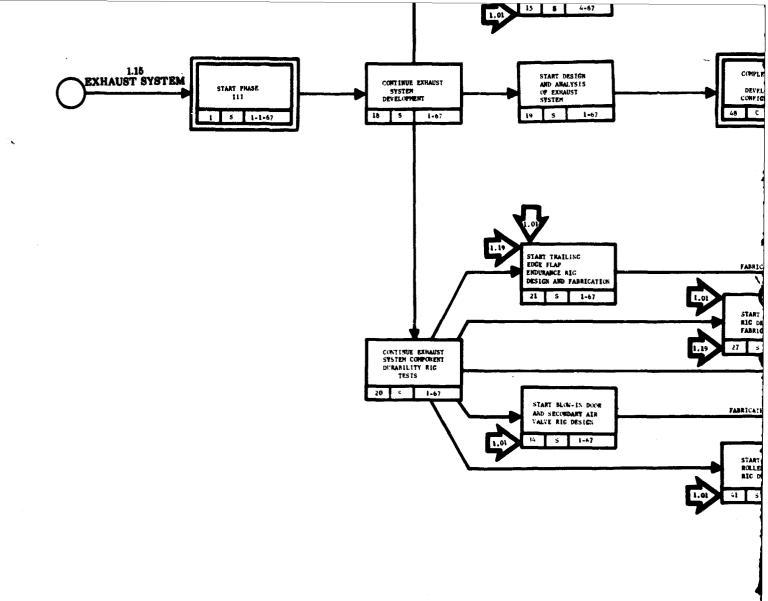
Figure 29. 1.15 Exhaust System











Event Sunber

De 6. F

START PHASE 111 Start of Phase 1 tres PAA.

CONTINUE BAHATAT Continuetyon managest sentery tents.

START MITERSPORT

COMPLETE MESTER . Complete or or so Complete on of w

START INSTALLATI Institute piecesis effects of acces perfectuore. In

Complete Partity Completes of a wider modern and Lucasia. Complete

Completion I is prototope continuities then texts of pr

CONTAIN COUNTY Completion of a test data. Corr system flight to

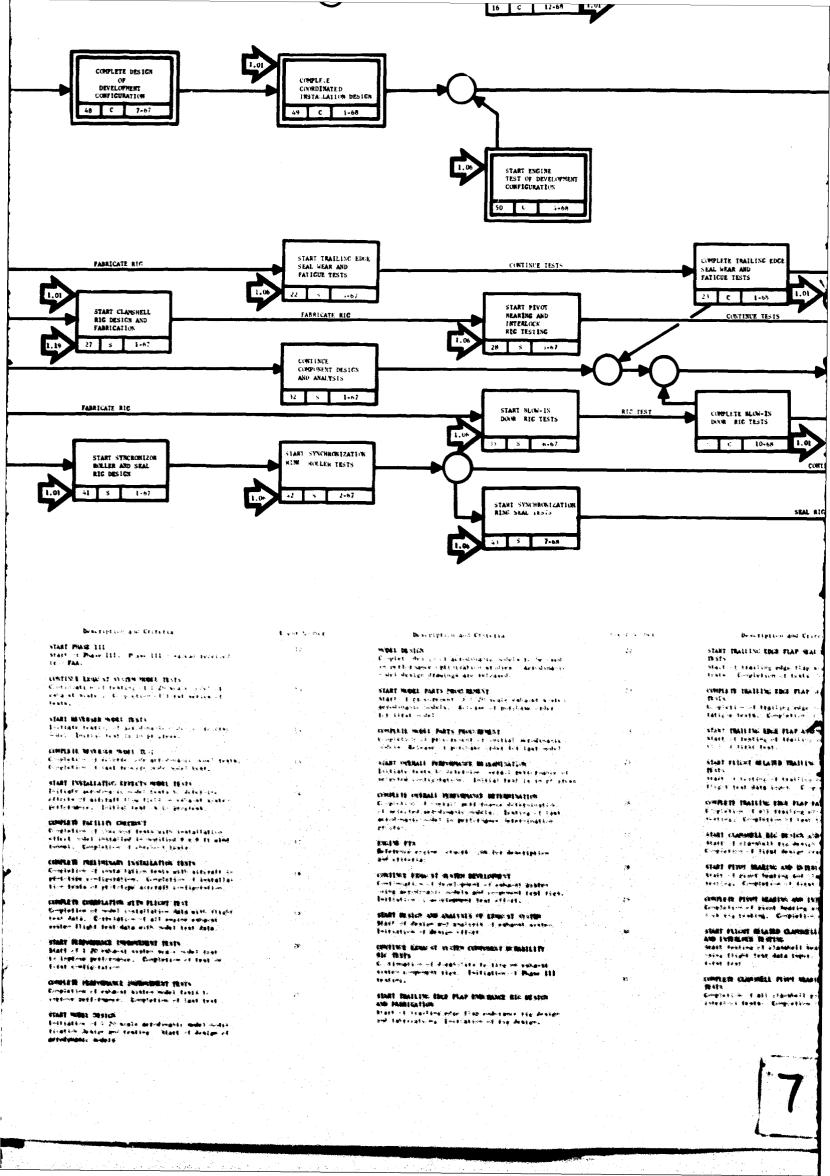
State Personal Sease of 1 for o to improve posts first configure

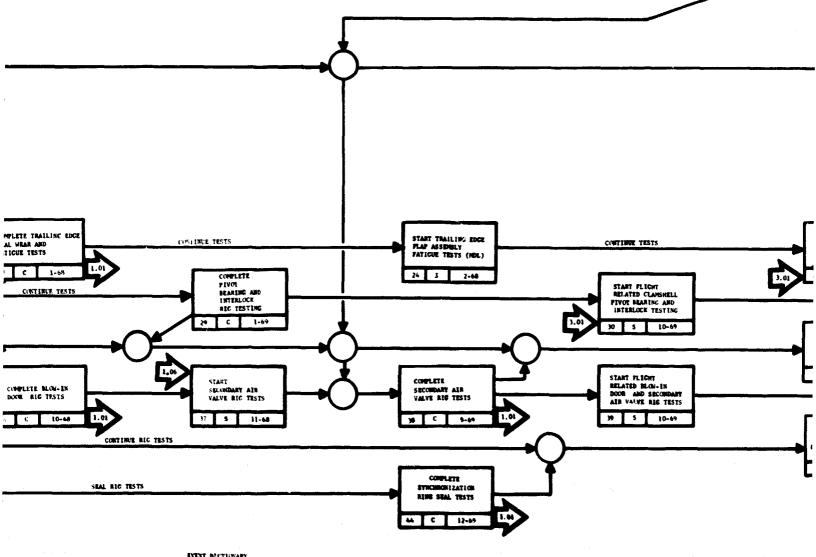
Completion of a Completion of a Laptonia factions

Statt maks bes Initiation of Disation dealers secondments and

Figure 30. 1.15 Exhaust System

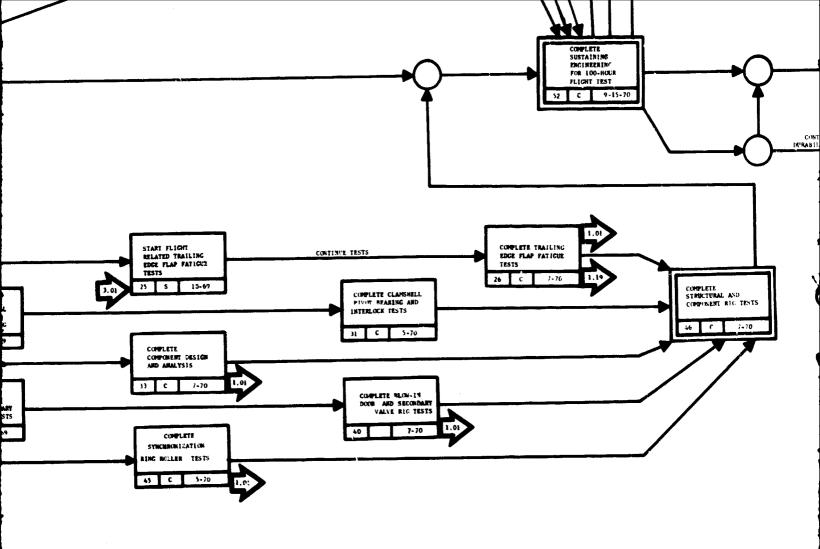
6





EVENT DISTIONARY

ANAT FRANCISC SIDE THAT WAS MADE NOT THE STATE OF THE STA	Description and Uniteria	ent Rones	Brackspecon and Cesteria	Event Musher	Bracespeson and Eggevesa
COMPAIR HALLING THAT WALL WERR AND FRATURE TO COMPAIR COMPAIR MINION AND ALALYSIS CONTROL OF THE COMPAIR AND ALALYSIS CONTROL OF THE COMPA	This's Start of Cracilising bulge brigh weigh weight girel right will	1	Continues on of and and material confidence to a gen-		beder ein mariar ut im aufm murebige er aufm
START MARITUM TRAIL TATAL SAME FLAT ANABORS SATISFE THE START AND TRAIL TO SAME SAME SAME SAME SAME SAME SAME SAME	Mata Complete continues engiting only 1) ap man higher and	11. (1.)	Completion of embass thaten congeneral design and	•	That is trating of respect models ago.
Part Marie	START TRAILING AND STAR ANDMAN PATTERS THAT'S	33	MERECON MONEY OF BEING SOME AND AND THE CONTRACT OF THE CONTRA		Completely of prosper magety is king and a completely of last tree!
Completion of first test Completion of first test Completion of completion of first test Completion of cold institute first first Completion of cold institute first first Completion of cold institute first first Completion of cold institute first Completion of	about filters means mailing that particle .	3 5	dfancing TART Michellishing Alic Phytis		Konglada will nakalah di nagla namanginya. Tang tollah dagan Kongapanin in lagan
START FARINGER AND TABLES AND TAB	simplette finitibe that the trap parties there		CONTEST MADE IN SUMPLES MATE		திரைந்திரை பிர் விர்க்கை உருந்தி நடித்த திருந்திற்ற இருந்திற்ற இருந்திரும். இது நடித்த நட
Semple of the design of the second of the se	tentine. Employees of their test. Staff thannels his million and familiation.		Plate t last tess SBART PROMINENT ALE TALLS SIGN SHIP		Initiation function feating at 480 as
Completion of first tone Completion of firs	Complete of Cook shedge desire,		platics of treat cost. CONSER SECONDARY and marel the firsts		Geriffe firm of fentige of felt except ent.
Staff Filest makes Completion of last test. Staff Staff Staff Staff Staff Makes Completion of last test. Staff Staff Staff Staff Makes Completion of last test. Staff Staff Staff Staff Makes Completion of last test. Staff Staff Staff Staff Makes Completion of last test. Staff Staff Staff Staff Makes Completion of last test. Staff Staff Staff Staff Makes Completion of last test. Staff Sta	COMPLETO PERSON MARINE AND LAMBRAGEN BLG TO STATE	*	Simple ties of Jak tool Sings filles Milatio Miles in but are springer	•	COMPLE COMMISSION INSTALLATION
Matt tenting of classificity and tenting and tenting and tenting and tenting and tenting of classificity and tenting of classificity and tenting of classificity and tenting a	Sink tik fedick, Completion of last test. staff tisent winds damage from theses:		State of testing on blooks and or or orders at some state. Completion of tiest test		Therefore the desire are released
STREET PROTESTANT AND STREET AND	Mast tretting of clambolt beating and sequences are every fire		MINE Completion of Manager and accordate retire	•	system. Initial employ test is in pice.
Placet Byt	Water		Matt of distance successions and the section		for empire PM teating. Leaving to a con-
	STREETE TRAIS. BOMBIERSON OF SAME TORE.		dul beat tis. Completion of Jissi dealer descine.		PLICET Byt



· int :	SYNCHROLIZATION BING BORLER PERTY.
3-1 .	OF A MILE IN SOLE BOOK DECTATION FROM
•	te tal. Completelon, t local tests.
- sat	THE BLANCH THE STRANGER
Leet .	of the atting to the single groups the state of the process of the
	RAG BAGT . REINBERTSVELLE TSTATT THE
weta:	the same and sometimes are
الإلاته	kā op ork nigars before parks on kiena i ment kanta kan
	tion of task trak

Description and criteria

ampiger vengammigagiem bind mottan flats Lugsekiem it mandank i joše nimiše vikakkiem Lug biljike senkali Kimpigekiem of Spak Neski

propiests proceptions and companies die regre-Lapinety in Categorican Anatory is discount categoricanies und debi Campinety in Spain Libert Englande und Senten Campinety in Stande

that theire that at appearance at AFRE with building at AFRE with a AFRE with a

contain medico of multiplicate emple parties of the contract of dealers of the contract of

endet dinchia tanto arratentatia dinitraciantista Etasti atalong kontong ud kontonal protostoja estimatist enstaro. Bostoai arratea fondo on or atratean

dillet PPs constactings in bytes a product suggestant yorkigo balish antistros do angion (PD tisting Burlipp datum of antistros mitgalatism sore PPs angion datum.

popularità de estatatante esactablestante perà con enicada estante illust e consumatione di concensionale di discoper de del

Benetiption and Eriteria

Barrit Minthers

- 2

SEERCE CERTIFICATION CONTICURATION
A local politic of scattering origination from well for sixtyants for source certification towards. The contiguration of seekertal configuration of seekertal configuration of seekertal configuration.

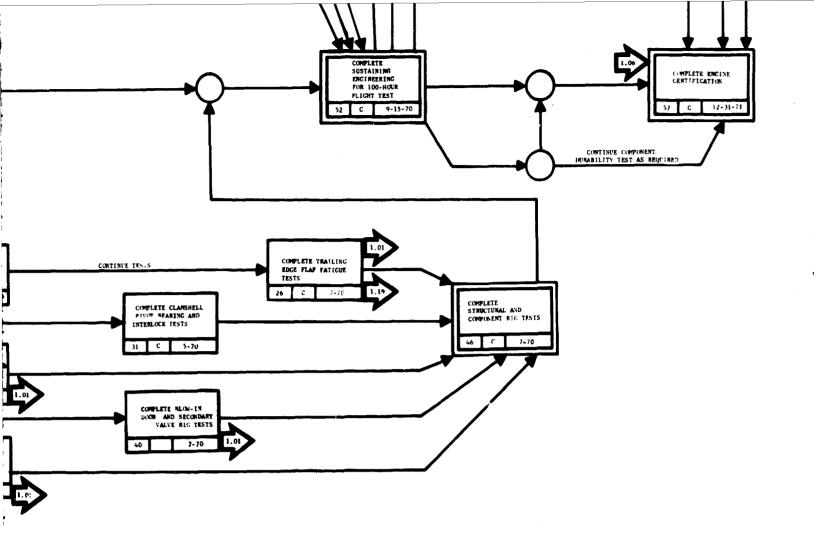
CONTRET JANUARIAN PRINCES TOTA Complete med maket trat I singsattasism etiactu, Roughusiam es hans sente

COMPANY TO MANUAL MASSICA AND ANALYSIS Completion of design and analysis for maket feather Completion of base made strange models are not

COMPLETE PARTY PRINCIPANT COMPLETE PRINCIPAL P

emiles contentation.

Believes engine network took top detect at the and statement



Beautiption and Criteria

state extification continuation in our colling to poster configuration that will be extincted for extending the continuation of extending the continuation of extending the configuration into configuration configuration into configuration configuration configuration.

COMPLETE INSTALLATION REPORTS THAT'S Completion of most from at installation effects. Completion of task tosis.

COMPANY MARK MESTIC AND ANALYSIS.

Somplets of the tight make that the model fields of Complets and the conditions of th

CONTROLS PARTS PRINCE MANNET.

Comp. characteristics, make, parts provided make.

Proposerous of bast part.

ENCENE CENTIFICATION.
Reference employee network C.CM distribution and cuttering

FD 17840

1 16 CONTROLS AND ACCESSORIES

FUEL CONTROLS AND ACCESSORIES

During Phase III of the JTF17 engine program, the prototype engine control system design will be completed, fabricated, bench tested, engine tested and flight tested. The prototype control design and development program will rely heavily on experience gained during the J58 engine development program and on present commercial engine experience.

While prototype control components are being procured, development engines will be operated with the modified J58 and TF30 controls used in Phase II-C. Additional controls of this type will be procured to support the development engine program. Information from operation of the development engines, development component rigs, and analytical and computer studies will be used in the refinement of the design of the prototype control system.

Bench testing of prototype control components will include both room temperature testing and environmental testing at simulated mission cycle conditions including fuel inlet temperature and ambient temperature. The objective of this testing is to subject the control components including the fuel controls, the fuel pumps, the ignition system and auxiliary valving to as nearly flight environmental conditions as possible prior to engine and flight test

The engine test program of the prototype control system will be directed toward evaluation of control performance at sea level test stand conditions and under the simulated flight conditions which can be simulated by the test facilities at FRDC. This testing will also accumulate engine endurance time on the control components. The engine test program includes the completion during Phase III of the engine FTS with the prototype control system. Prototype control components will be procured and updated as required to support the engine development program.

The initial 100 hours of aircraft flight testing will evaluate the control system over the flight envelope. Flight testing will also demonstrate engine/inlet/exhaust system compatibility and indicate any problems not resolved by the engine/inlet/exhaust test stand programs. Development programs will be initiated to resolve control system problems encountered in bench testing, engine testing, and initial flight testing.

Analytical design and development coordination will be maintained with the airframe manufacturer to ensure that compatible system performance is achieved; that installation requirements are satisfied; and that engine/inlet/exhaust system tests and initial flight testing are coordinated. Analytical studies and computer programs will be continued to verify the validity of the control system requirements and parameters, as required, to coordinate engine performance with control and inlet system scheduling and dynamics, and to resolve specific control system problems. Major emphasis will continue to be placed on system simplification.

Pratt & Whitney Aircraft

PWA FP 66-100 Volume V

SO SECULIAR SECULIAR

VALVES, ACTUATORS, LINES AND FITTINGS

In support of JTF17 engine testing, actuators, compressor bleed valves, lines and fittings development tests will be conducted during Phase III.

The compressor air bleed valves are very similar to the poppet valves utilized in the commercial JT8D and military JT8 engines. These valves are located on the gas generator and are required to provide reliable, trouble-free operation after long periods of exposure to high temperature. Extensive testing which will include calibration, cycle and exposure under hot and cold environment, contamination, and flow capacity tests will be accomplished.

Linear actuators that operate the high compressor variable inlet guide vanes (ICV), the variable area duct nozzle, and the reverser-suppressor clamshells are required to perform through a wide range of working fluid pressures and temperatures and ambient temperatures; to maintain stable operation for varying load conditions; and to operate with negligible overboard leakage. The major areas of actuator development will be directed toward substantiation testing of substitution of titanium alloy for Greek Ascoloy material (AMS 5616), which should provide substantial weight savings, and development of the required dynamic seal durability. Extensive testing which will include hot and cold environment, calibration, heat transfer, endurance, and contamination will be accomplished.

An alternate mechanical actuation system will be studied to evaluate the feasibility of simplifying the actuation system and to assess the advantages and disadvantages of mechanical system development in relation to the JTF17 hydraulic actuation system.

The engine lines and fittings must safely carry the working fluids to several locations on the engine through a wide range of operational pressures and temperatures. To accomplish this task, these working fluid lines employ tubing that ranges in diameter from 5/16 to 2-1/2 inches with wall thickness that ranges from 0.035 to 0.065 inch. Mechanical tube connectors are utilized to provide quick installation, servicing and removal of the components, and to provide ease of engine disassembly and overhaul.

Major effort will be expended on lines and fittings to develop titanium tubing and mechanical connectors which are compatible with titanium tubing, and related seals. This effort will consist of upset forming, welding, bending tests, vibratory tests, salt water tests, fuel and oil compatibility tests, heat transfer tests, and mechanical connector and seal tests.

The major milestones, network charts and event dictionaries for controls, valves, actuators, lines, fittings and accessories are shown in figures 31 and 32, respectively.

A detailed description of controls, valves, actuators, lines, fittings, and accessories development is presented in the Test and Certification Plan, Volume III, Report E, and test planning and integration is presented in Test, Volume IV, Report E.

AND SECTION OF THE SE

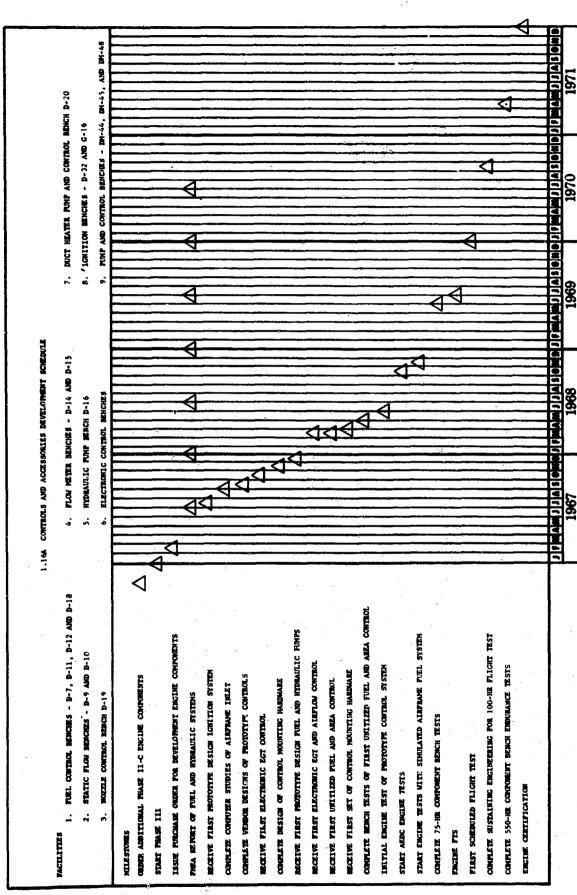
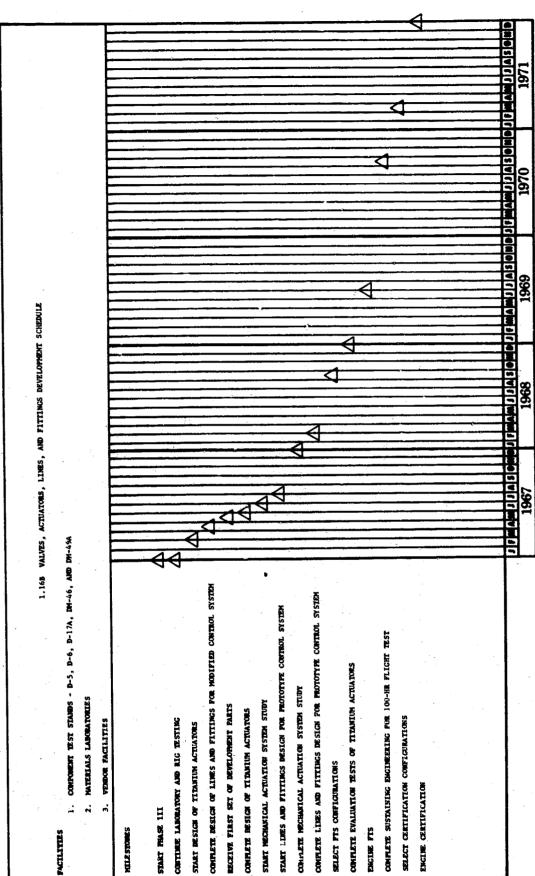


Figure 31. 1.16 Controls and Accessories (Sheet 1 of 2)

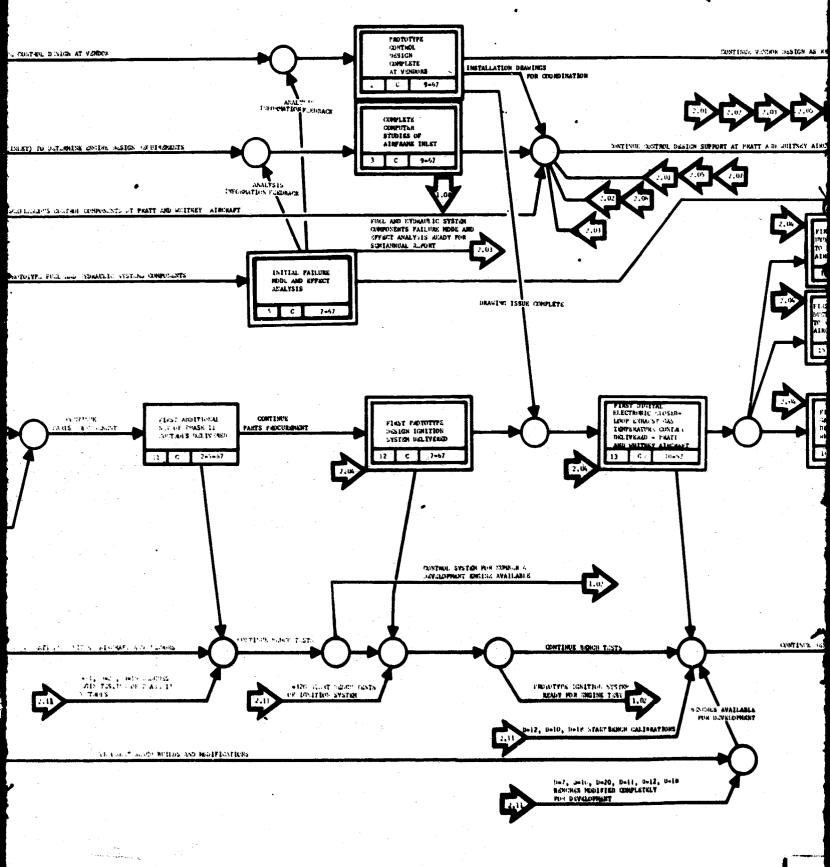
Pratt & Whitney Aircraft
PWA FP 66-100
Volume V

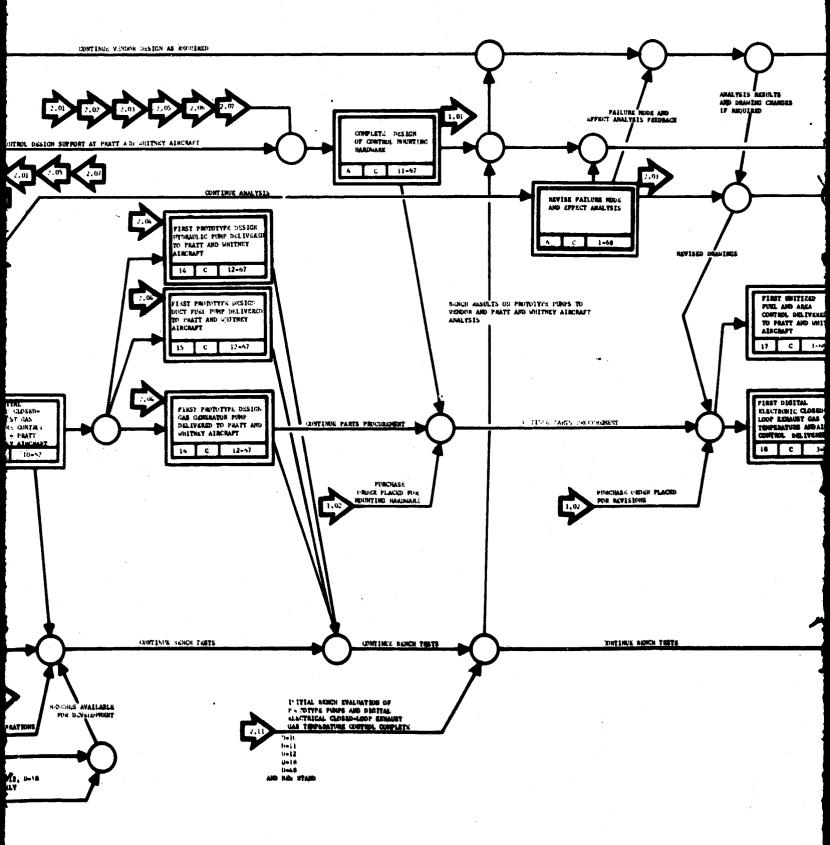
FD 17875 VH

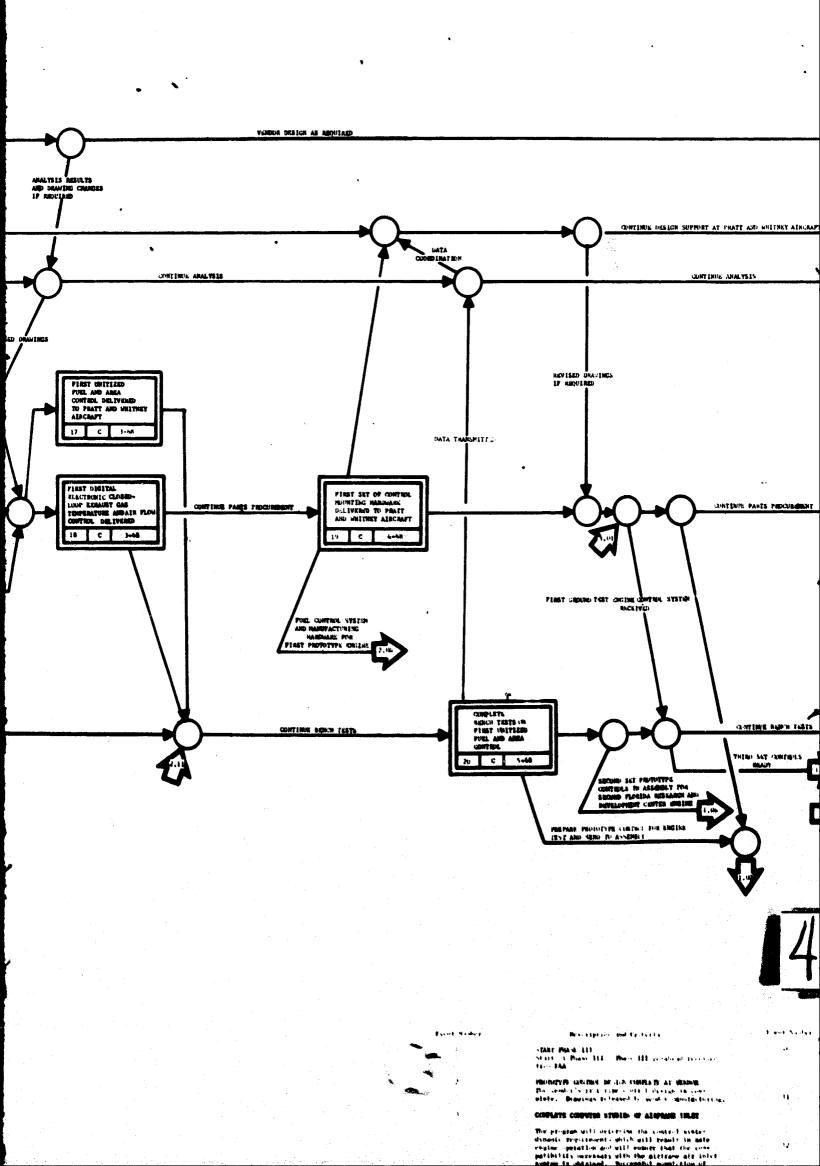
AND SECTION OF THE SECTION OF THE PROPERTY OF THE SECTION OF THE S



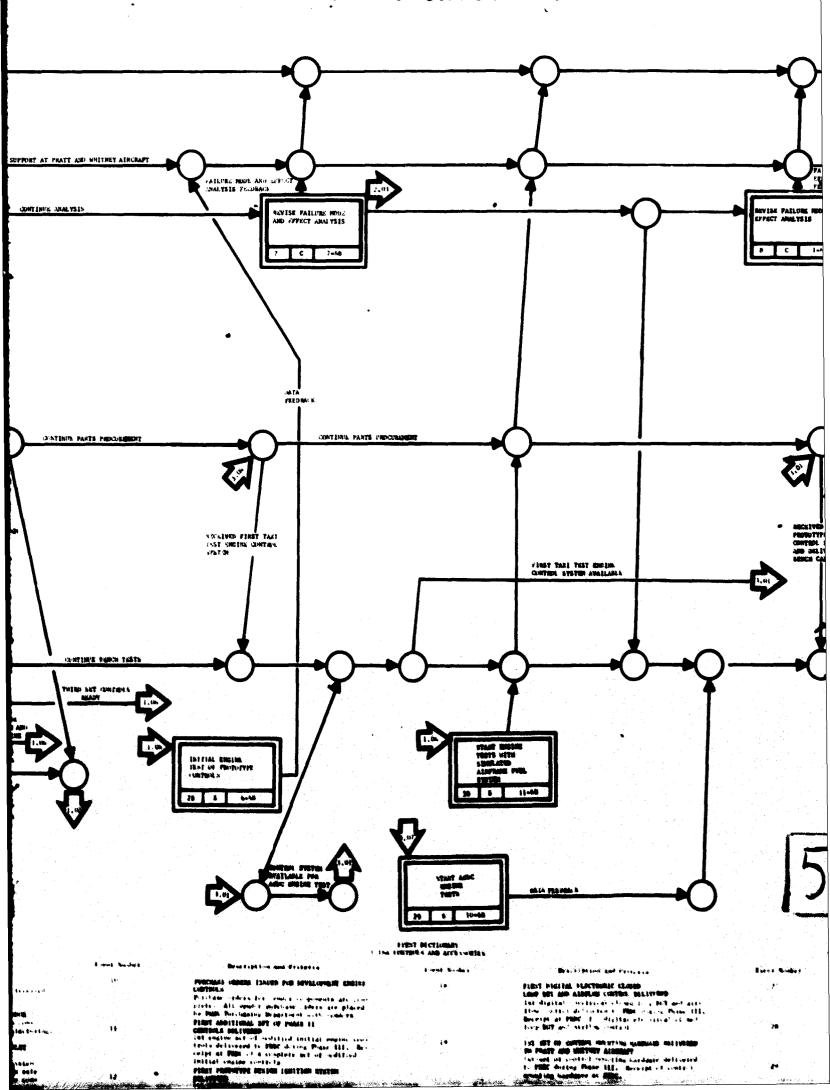
1.16 Controls and Accessories (Sheet 2 of 2) Figure 31.

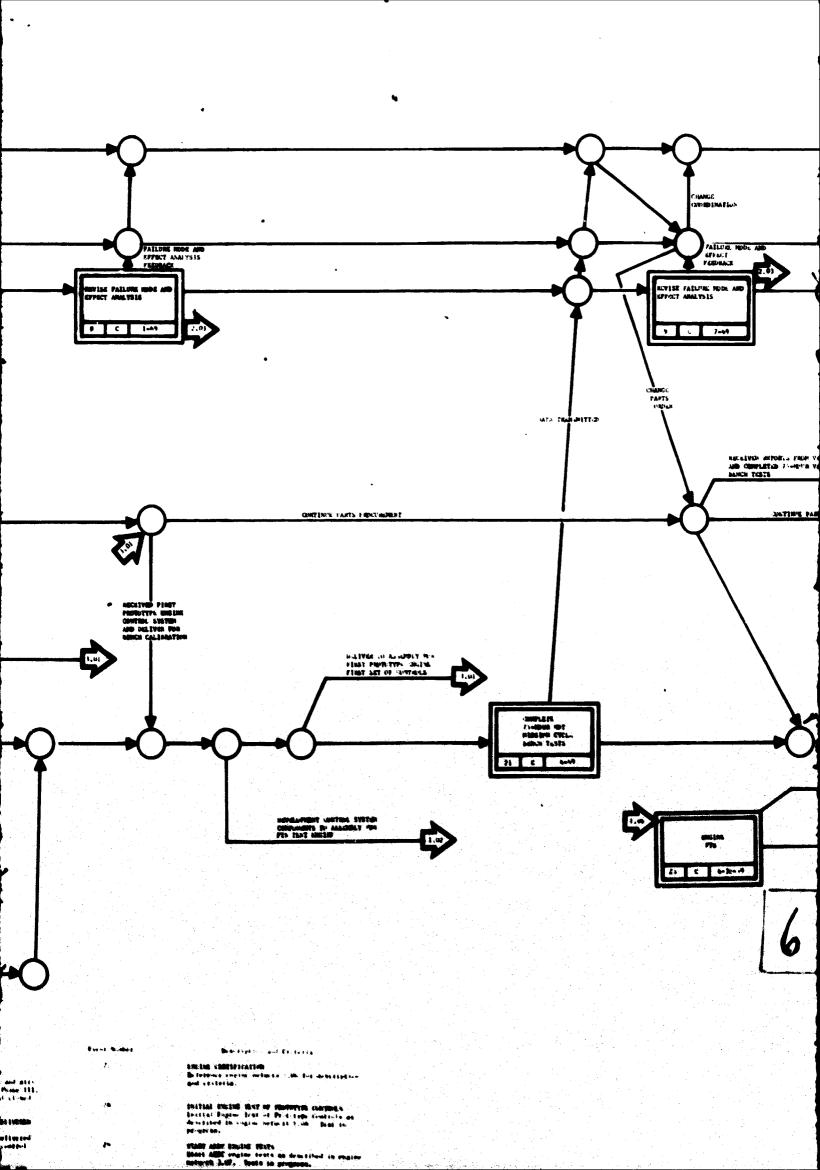


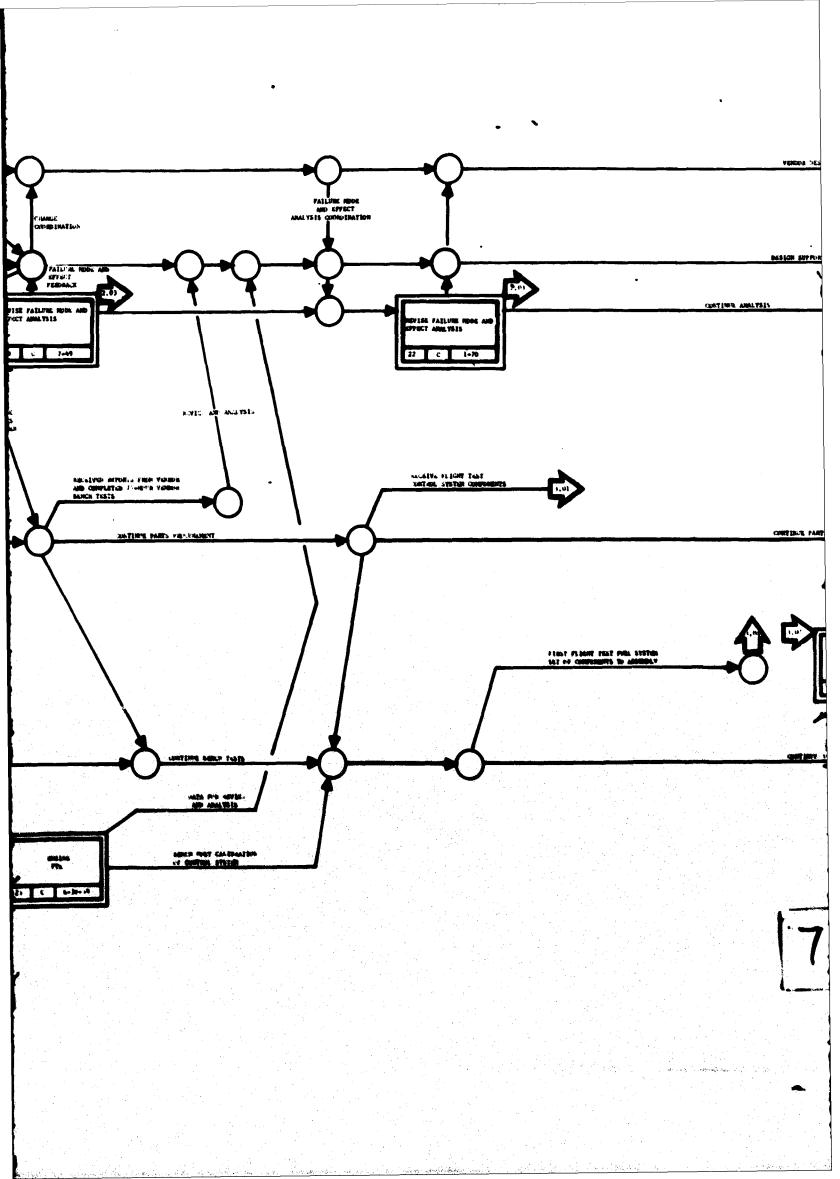




1.16A Fuel Centrels and Accessories







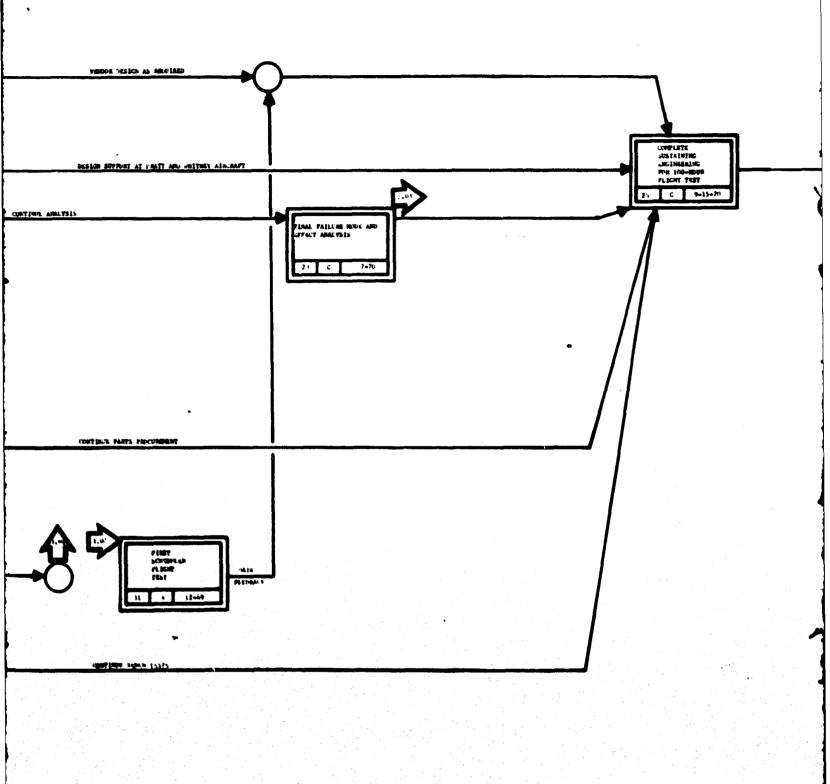
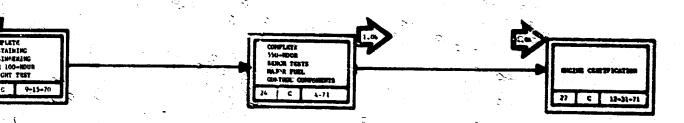
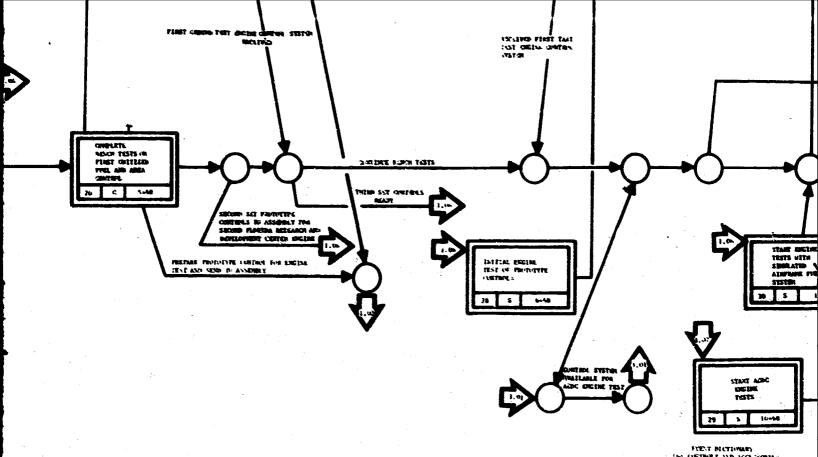
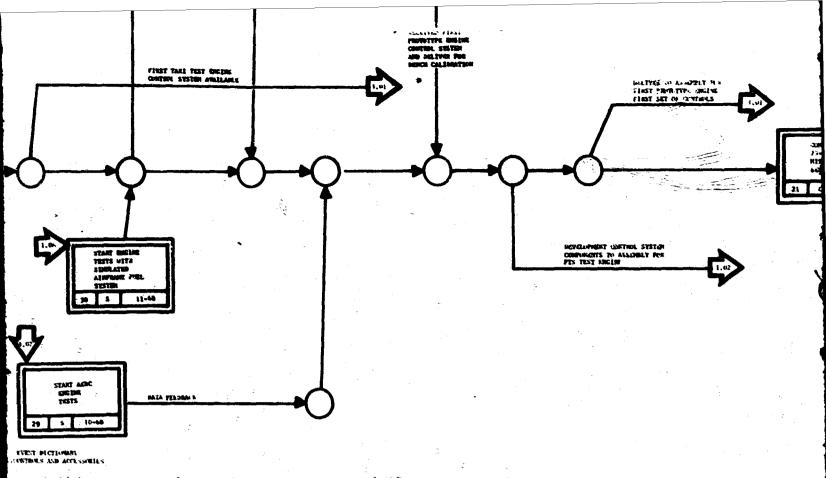


Figure 32.





	2		THE OWNER AND AND SHIP
Descriptions and travels	Frent Number	Bernettige bie and Cereweia	Covers Numbers
START PROME TELL Start of Biase TELL Phase 182 revalend recovery the FRA	16	PUBLISHED ORDERS ISSUED FOR DEVELOPMENT ENGINE CONTROLS Probase orders for remotive property are com-	
MODIFIES CARRIED DESIGN CONTROLS AT VESSEN. The conductive protection of the computer com- plete. Branches released to an electronic con-	: 4	Piers. All rends a prechase orders are placed by PMM. Prichasing to parefront with consider, PIEST ADDITIONAL SPT OF PMACE II CONTROLS DELIVERED.	
COPPLETE COMPUTER STREETS OF ALIVERNIE THERE		int emption not of multitud fratial engine con- troto de l'orted es PRDC during Plane III. Re-	**
The program wills determine the control scatters demands texposed ents which will remain in material repeated in and will enter that the consists which is not remained at interest and interest of the consists of the consist of the program will be seen by the constraining or a complete standard on the first standard on the first standard on that the description of the program of the consists of the program of the consists of the program of the description of the consists of the procedure of the description of the consists of the procedure of the description of the consists of the cons	12	coupt at PRDC of a complete set of solified institut source controls; PIRST PROTORTER DESIGN (CRITICS SYSTEM DELIVERED) List prototing contribution with solificated to PRDC daring Pisses [11]. Receipt at PRDC of a print day in military source. PIRST DIGITAL ELECTRICATO CROSS LONG DET CONTROL DELIVERED to PRATT AND WHITHEY	.0
CONFLETE DESIGN OF CHETPOL MARKETHE MARRIAGE COLES C NATIONAL OFFICE AND PLOTS IN FRICE OFFICE OF OFFICE AND THAT SECURITY.		Alberraft to the transfer of the particular to the particular to the transfer of the transfer	21
INITIAL FACIORA MODE AND EFFECTS ANALYSIS. Complete an autical PMEA on JTELL root beatables and teachers measurements, Political the PMEA an period teachers.	4.	FIRST PROTORYPE DESIGN HYDRAULIC PUMP LELIURGE TO PRATE AND MILITARY ALRUMATE ist protorse controlly people consenses to PMA during Phase 111. Receipt at FREC of a protor	. .
BEVISE FAILURE NODE AND EFFECTS ANALYSIS BOVEN the publishing PMFA of JTD 1; not a postunity and equation souther components. Postunity of PMFA and publishing the component of the publishing the component of th	- 4 3	type hydratic payp; FIRST PRESCRIPT DESIGN DUCT FUEL PURP DELIVERED TO PRATT AND WHITNEY AIRCRAFT OST prototype don't had peop delivered to FEDC duction Phase III. Receipt of a prototype doct	2 .
MRITISE FAILURE NAME AND EFFECTS ANALYSIS Recise the existing FNRA ye difficiently hadranise, and ignation salters compounts. Poblish the FNRA despate Commissional Relability repo-	46	tool mad at FREC. FIRST PROTOTYPE DESIGN CAS GENERATOR PIND DELIVERED TO FRATT AND UNITERY AIRCRAFT tot prot type gas constator peop delivered to FREC disting Phase III. Receipt of a prototype gas generator pop at FREC.	2
NOVINE PALLIER HORE AND EPPLITS ANALYSIS ROVINE EXISTING PPRA OF THE THEIR BULLANTIA and partition systems components, Publish the PMSA ampirt of administration Reliability reports.	17	INT PRITIZED FOR AND ARMA CONTROL DELIVERSD TO PRATE AND MILITRY AIRCRAFT. INT UNITIZED FOR AND ATTO A SOUTH OF STREET OF PRIOR OF UNITIZED AND ATTO A PRIOR OF UNITIZED AND ATTO A SOUTH A PRIOR OF UNITIZED AND ATTO A SOUTH A PRIOR OF UNITIZED AND ATTO A PRIOR OF A PRIOR OF UNITIZED AND ATTO A PRIOR OF A PRI	
REVISE FAILURE NOW AND EFFECTS ANALYSIS Revise the existing PHAs on ITEL tool, bullenels, and spoilten washens components. Publish the PHAS AS part of scridenial Revisibility reports.		tized bel and grea control.	26



Dent Elpesien and Cristingia

FIRST DIGITAL ELECTRONIC CLOSED LOOP BCT AND ALBELOW CONTING DELLYFRED 18t digital electrical cloud loop FOT and altrates control delicered to TRDs dorma Trans III. Receipt at FROC of a dicital electrical closet loop BCT and altribus control.

IST SET OF COSTROL PRINTING MARDMAN DELIVERED TO PRATE AND MRITSEY ALREADY for set of costrol institute hardware delivered for set of costrol institute hardware delivered to FREC during Phase III. However of control positing database of FREC.

COMPLETE NESCH TESTS ON EST ENTITIZED FOR AND AREA CUNTRY.

AREA DURTHY.

Broth rests on last improved fact and area con-trol are is plotte. Furtised the land area con-trol delicerted to component atotes.

COMMETE 75-184 R HOT MISCHO, CYCLE BENCH TESTS. Tradeout not crissed to stoke bonch test for control system completed. Solds feet report published.

REVISE FAILURE NOR AND EFFECTS ANALYSIS Review the exhabitor PMEA on JTF12 tool, including and fertition analysis components. Publish the FMEA as part of as tagened Reliability reports.

FINAL PAILURE WERE AND EFFECTS ANALYSIS Make front invision on the extering FMEA fuel hydraulic and ignition mystems components. Polish for Ional FMEA as part of my iannual Refinability reports.

COMPLETE 150-HOLR BENCH TESTS MAJOR PUEL CONTROL

CHINENES STATE COMPLETE OF SAIDT 10F1 CONTROL COOPERS ARE COMPLETE. Brightest reports poblished.

ENGINE PTS

Reference ongine network 1.06 for description and criteria.

COMPLETE SUSTAINING PROINCERING FOR 100-HOUR

Statistics engineering for 1865-hour (light test completed. 1665-hour flight test completed.

Ben 2) pro . . and Crateria

CHAINE CERTIFICATION Between enjour octuers with the descraption and engleria.

INITIAL ENGLE TEST OF PROTOTYPE CRITICALS Initial Engine Test of Prototype controls as described in ongoes inductable. Test in prototype.

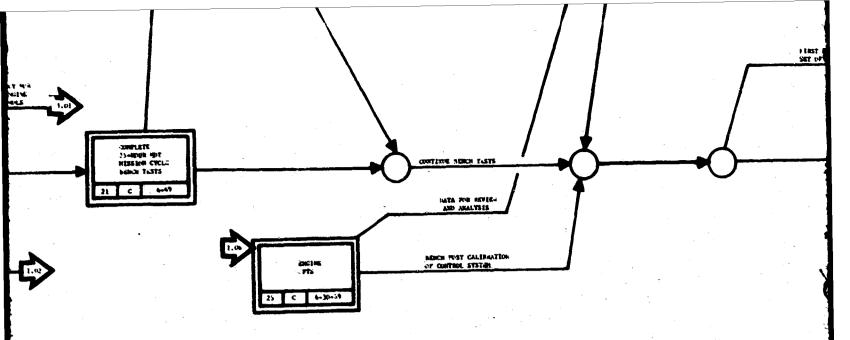
START APPC ENGINE TESTS
START APPC engine tests as described in engine
network 3.07. Tests to progress.

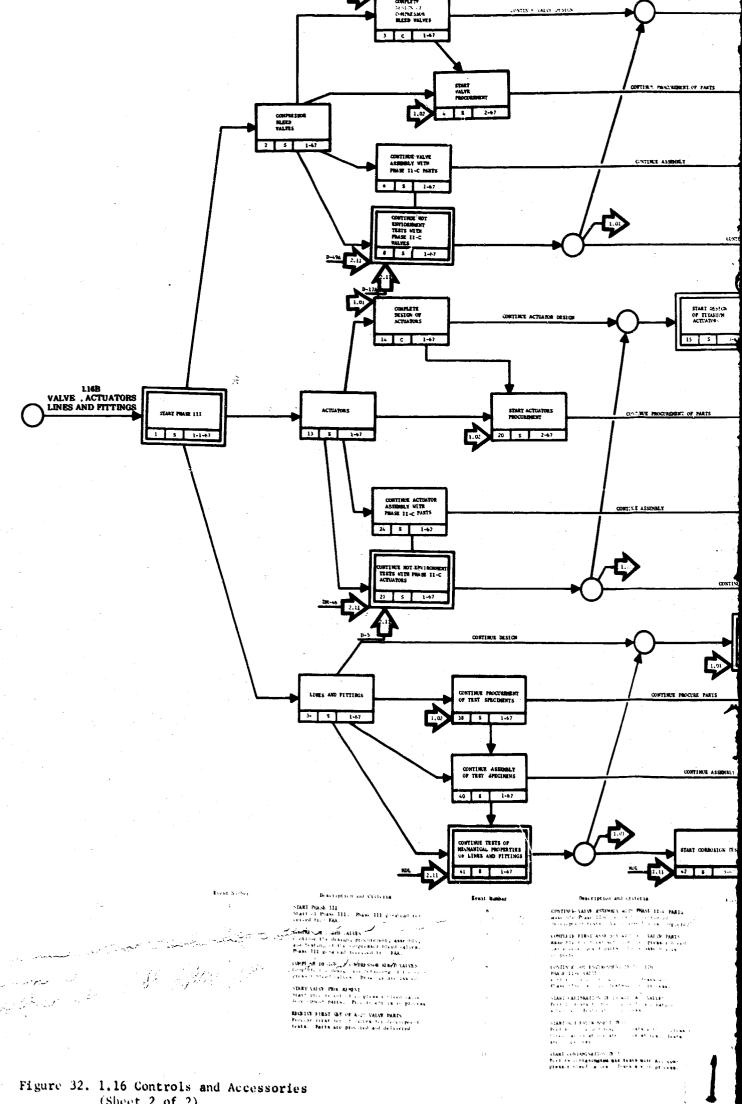
STARY ENGINE TESTS WITH SIMILATED AIRFRANE

FIEL SYSTEM

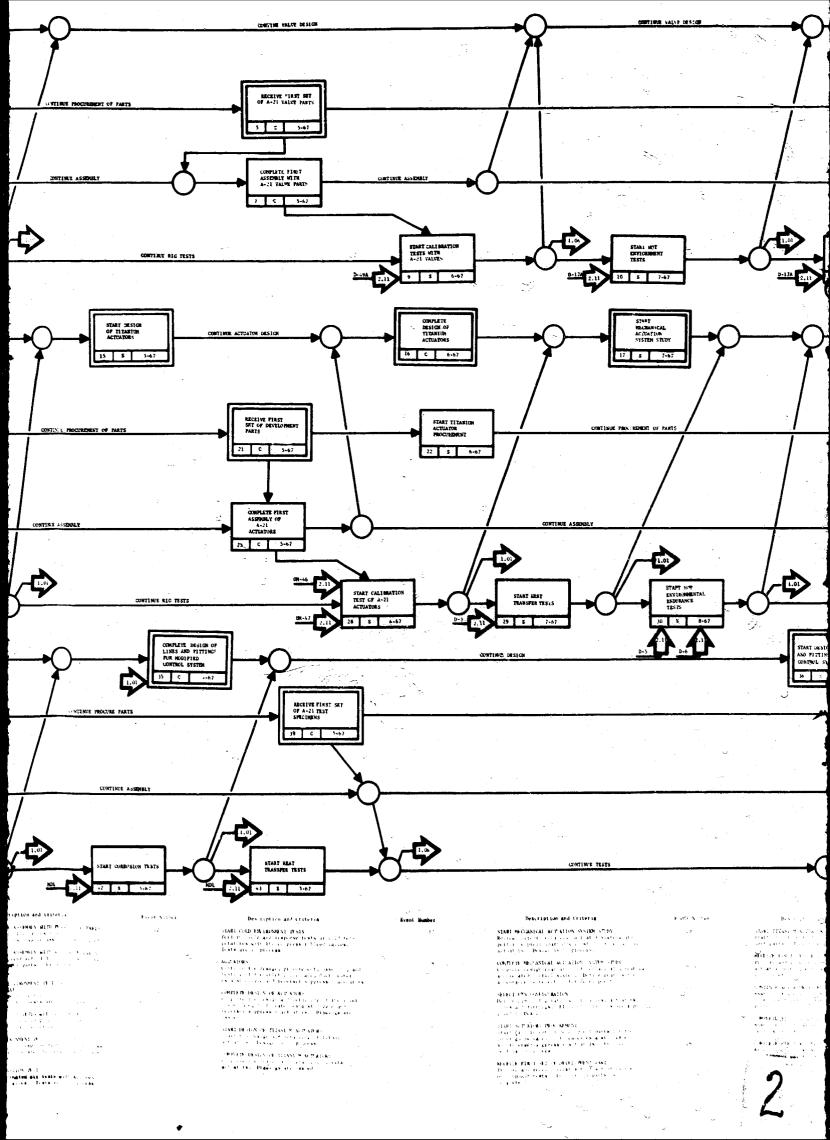
FILL SYSTEM Statt engine tests with stailared artifice tool system as described to engine network 1,100. Tests to progress.

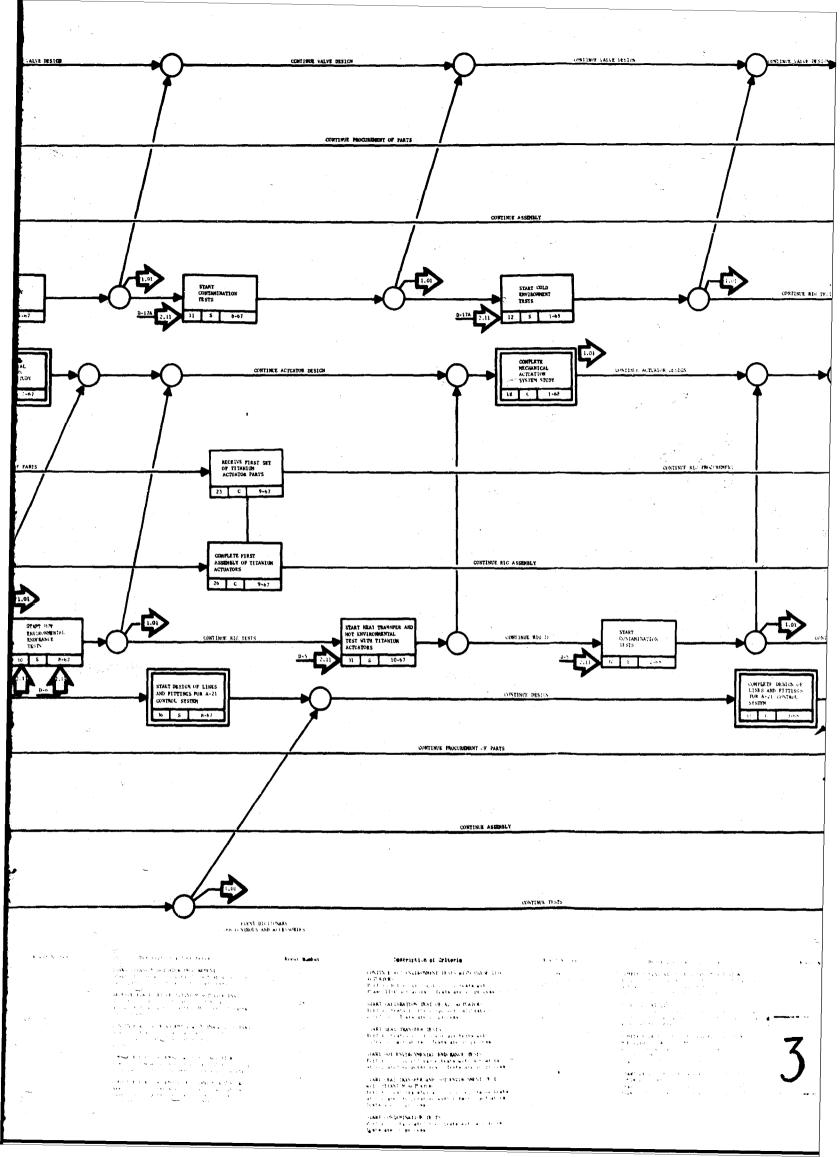
FIRST SCHEDULED PLICAT TEST First scheduled Hight test as described to counterporture 5.07. Test in progress.

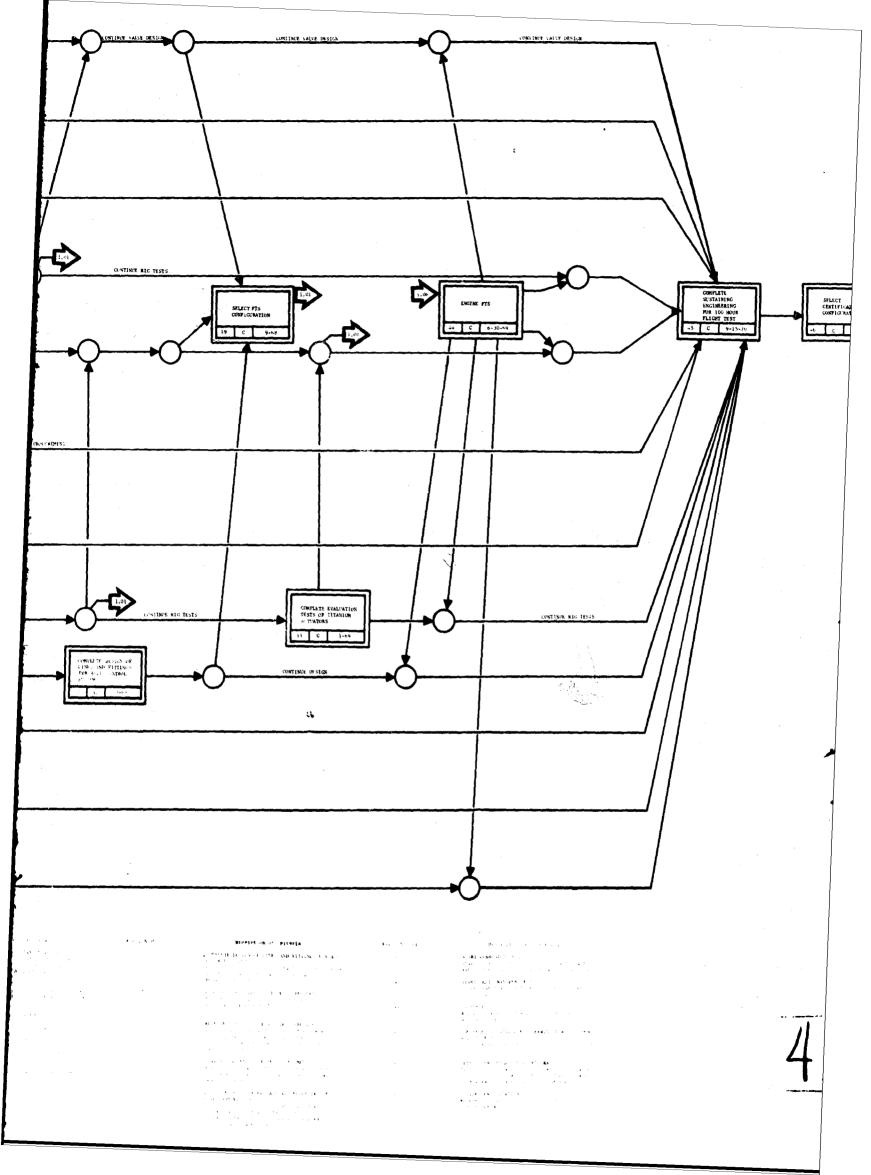


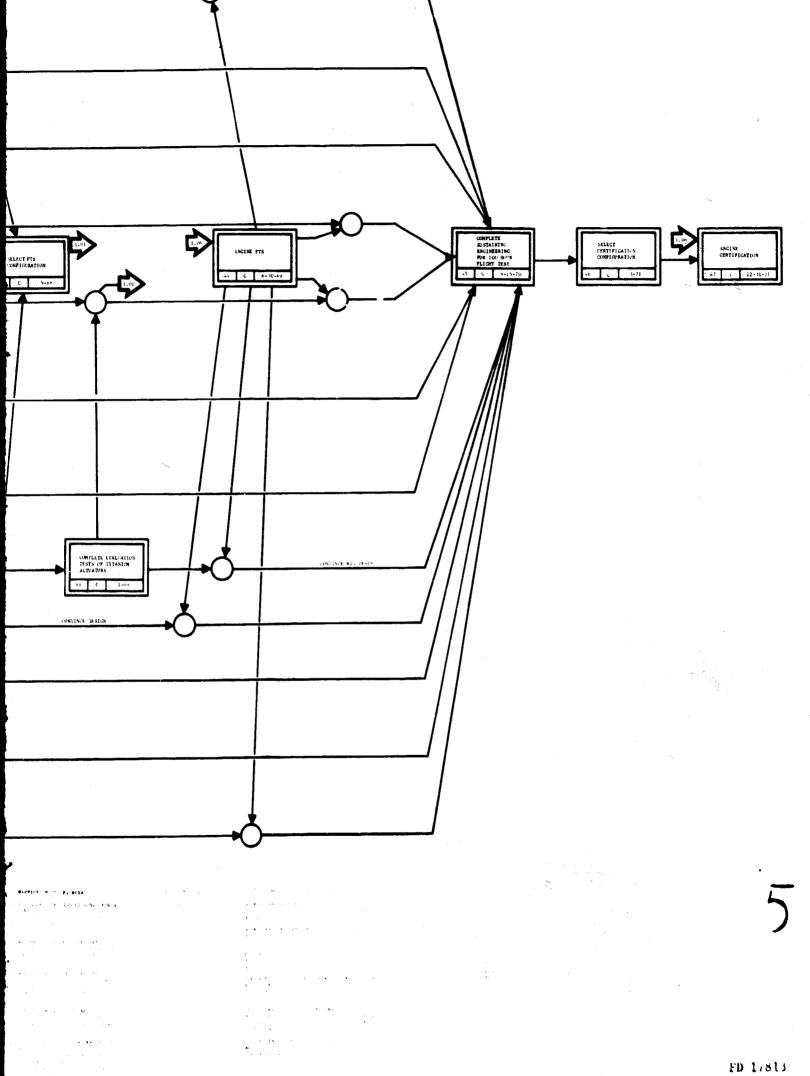


(Sheet 2 of 2)









1.17 LUBRICANTS, LUBRICATION SYSTEM, BEARINGS, SEALS AND GEARS

LUBRICANTS AND LUBRICATION SYSTEM

A continuing program of lubricant investigation including service evaluation will be conducted to promote the development of the highest performance engine oils attainable within acceptable economic limits and to prove their suitability by engine, rig, and laboratory tests. Testing, other than that in the development engines, will be accomplished in closely controlled engine compartment and gearbox system rigs to define the thermal stability characteristics of the lubricant at engine lubrication system temperatures, and to define the tolerance of engine bearing and seal compartments and lubrication system components to the specification lubricants under simulated engine environmental conditions. Sampling and monitoring procedures will be established and maintained on the development engines to provide data to identify potential mechanical problems and to extend the oil use time by eliminating fixed drain periods for the JTF17 engines.

BEARINGS, SEALS, AND GEARS

Bearing, seal, and gearbox testing will be carried out on bearing and seal rigs, complete compartment test rigs and an integrated gearbox - lubrication system rig. Pratt & Whitney Aircraft engine development and flight experience has proved the necessity of exhaustive testing of bearing and seal components in compartment rigs for the success of an engine development and certification program. Bearing, seal, gearbox, and lubricant system performances are dependent on each other and the test program will be formulated with this in mind.

The specific objective of the bearing program will be to evaluate the performance characteristics of all major bearings in the JTF17 engine, including towershaft bearings, compartment thrust bearings and compartment roller bearings. Engine bearings will be overload-tested at simulated environmental conditions to accelerate the evaluation of bearing life. The testing program will be conducted at simulated environmental conditions with the selected lubricant.

It is the specific objective of the seal program to evaluate the performance of the major seal assemblies with the selected lubricant at environmental conditions. Compartment rigs that simulate the engine compartments will continue to be tested utilizing actual JTF17 bearings, seals, scavenge pumps, housings, and associated hardware. These tests will include seal performance, endurance testing, and evaluation of alternative seal materials and designs.

Pratt & Whitney Aircraft engine development and flight experience has shown the value of a gearbox component program which stresses rigorous testing of gearbox configurations under simulated environmental conditions. The JTF17 gearbox test program follows the same type of program as pursued in the J58 gearbox development.

Pratt & Whitney Aircraft

PWA FP 66-100 Volume V

The engine gearboxes consist of the main accessory gearbox, the secondary accessory gearbox, and the power takeoff angle gearbox. The program includes testing of individual gearbox components and complete gearbox assemblies. Each gearbox will undergo endurance testing with and without environmental conditions. In addition, the gearboxes will be tested in an integrated system rig which has proved necessary on previous programs. The integrated system consists of a rig which is capable of running all of the gearboxes along with the associated oil sump, the oil tank, the main oil pump, the fuel-oil coolers, the bearing and seal compartments and oil plumbing. The gearbox accessory drives will be loaded with water brakes and will be tested both at ambient and simulated environmental conditions. The integrated gearbox system rig also will be used to evaluate selected lubricants.

The program will be directed toward completion of FTS and certification testing in the integrated gearbox system prior to completion of the engine Certification Test.

The major milestones, network charts and event dictionaries for the lubricants, lubrication system, bearings, seals, and gears program are shown in figures 33 and 34, respectively.

A detailed description of the lubricants, lubrication system, bearing, seal, and gearbox development is presented in the Test and Certification Plan, Volume III, Report E. Test planning and integration is presented in Test, Volume IV, Report E.

Pratt & Whitney Aircraft PWA FP 66-100

Volume V

FD 17876 VII

1971 1970 1969 1.134 LEMICASTS AND LEBRICATION SYSTEM SCHEMELE 444 TO COMPOSITY THAT STANDS - P.L. P. S. L. F. B. D. AND D. ST. TERME CALERALISM MET 18 TO 18 DEVICE AND 18 DEVICE AND THE NAME OF A STATE OF THE S 森の 瀬口 (Auditionの 14年) 第10 アンドン 「東京南」と (東京南) (1980年) (1980年) (1980年) (1980年) (1980年) (1980年) (1980年) · 新教育 2.3 (1.4) CHARLES AND AND AND ARRESTMENT OF RESIDENCE PATERIALS LANGER PRINTS SECTION FACTORISMS CHARL BELLS OF PURE-SOLE CONSERS. STARL MATERIAL OF STREET THE PART TALE Tatal PACTURES

1.17 Labricants Lubrication System, Bearings, Scals, and Gears (Sheet 1 of 2) Figure 15.

Pratt & Whitney Aircraft

PWA FP 66-100 Volume V

FD 17877

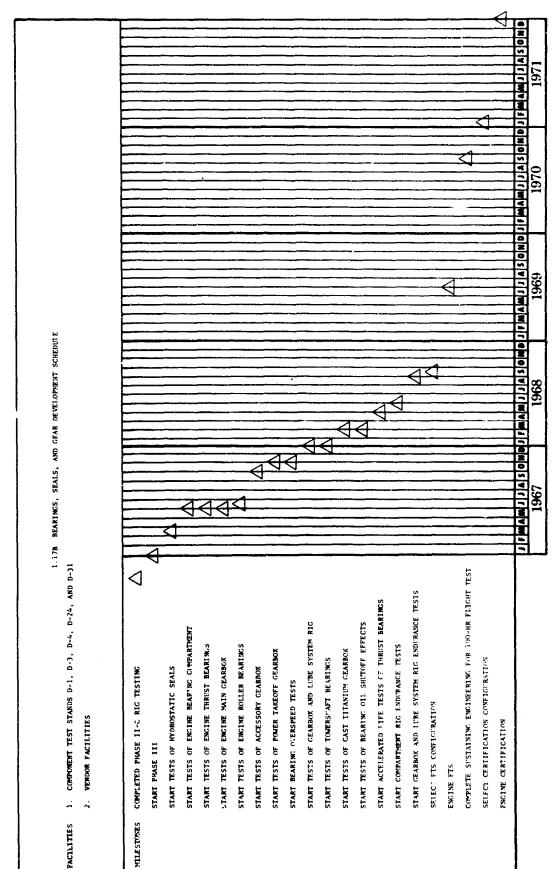
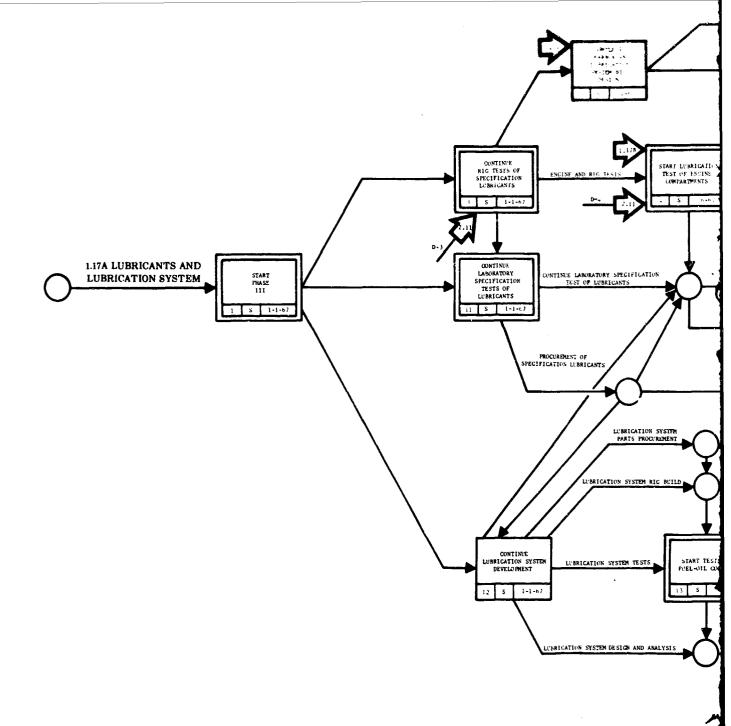
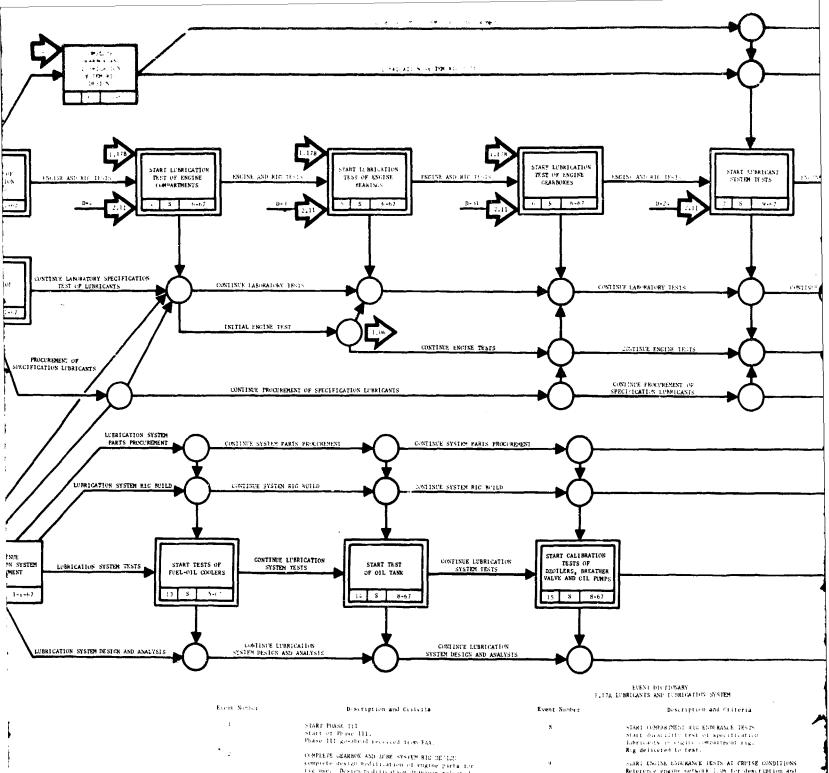
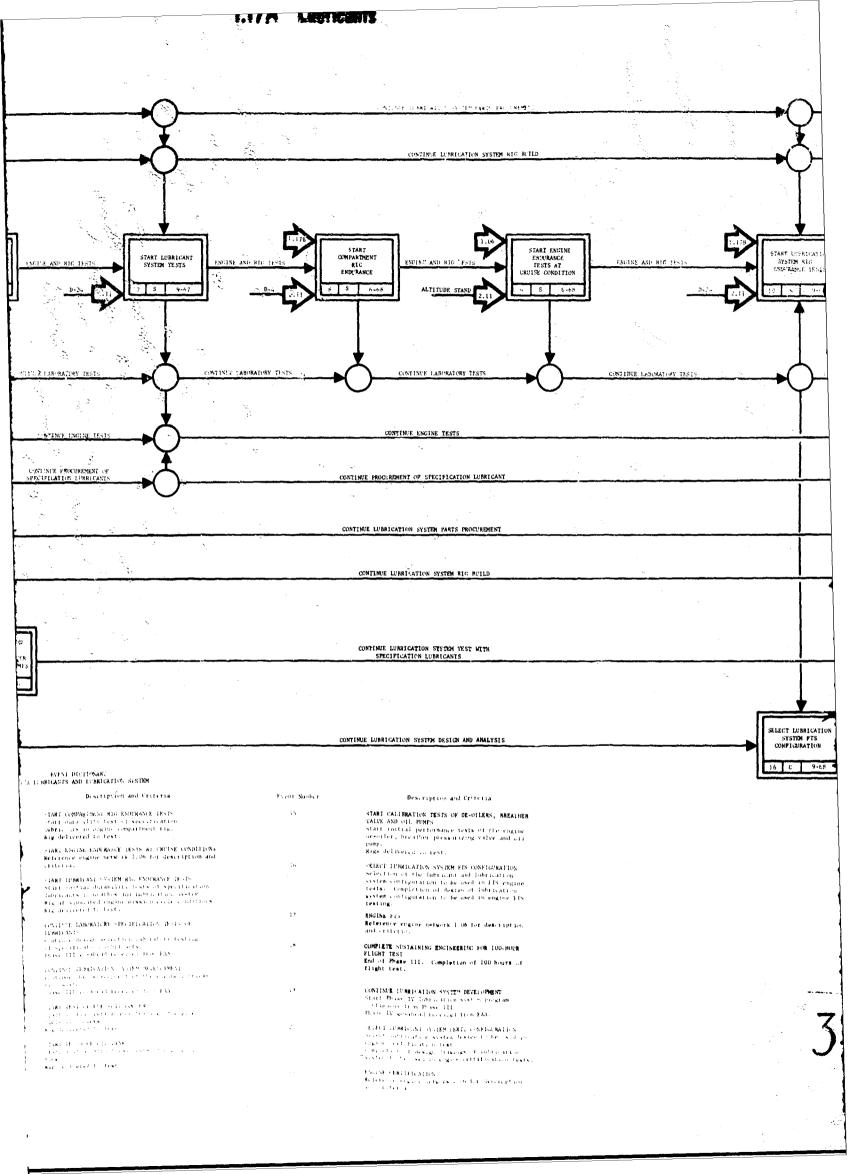


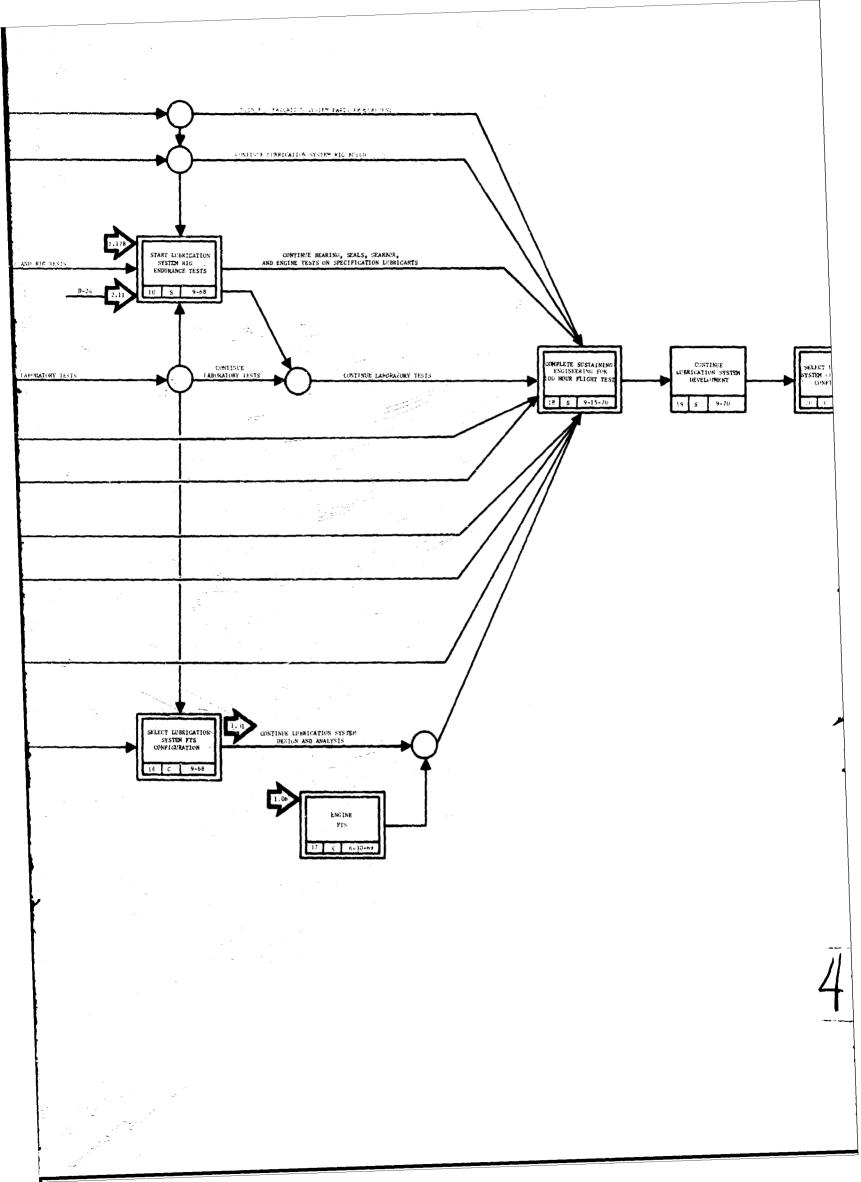
Figure 33. 1.17 Lubricants, Lubrication System, Bearings, Seals, and Gears (Sheet 2 of 2)

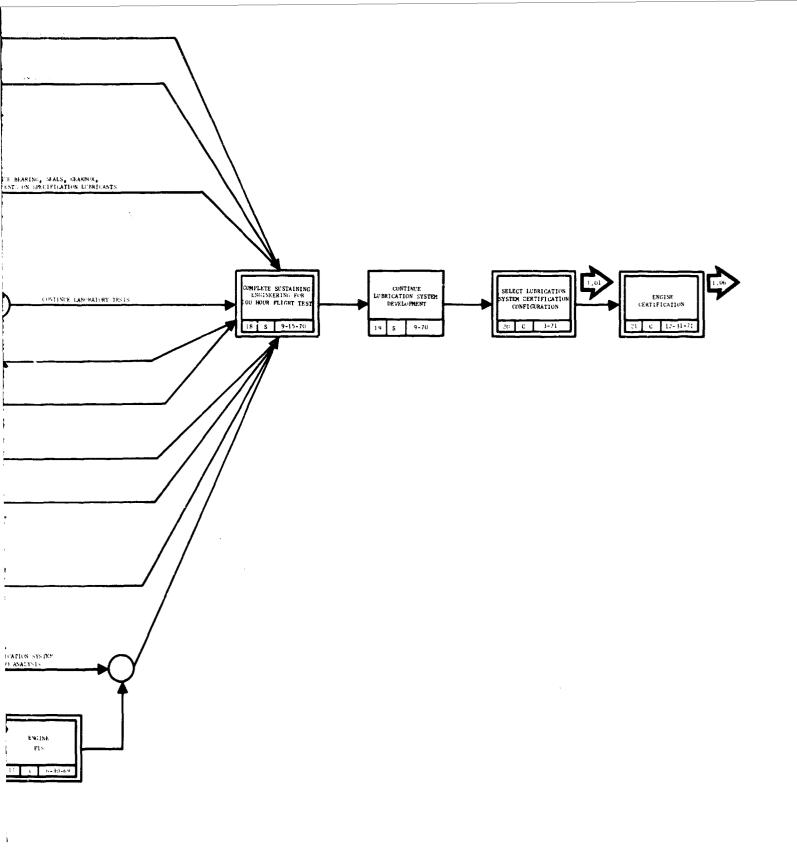


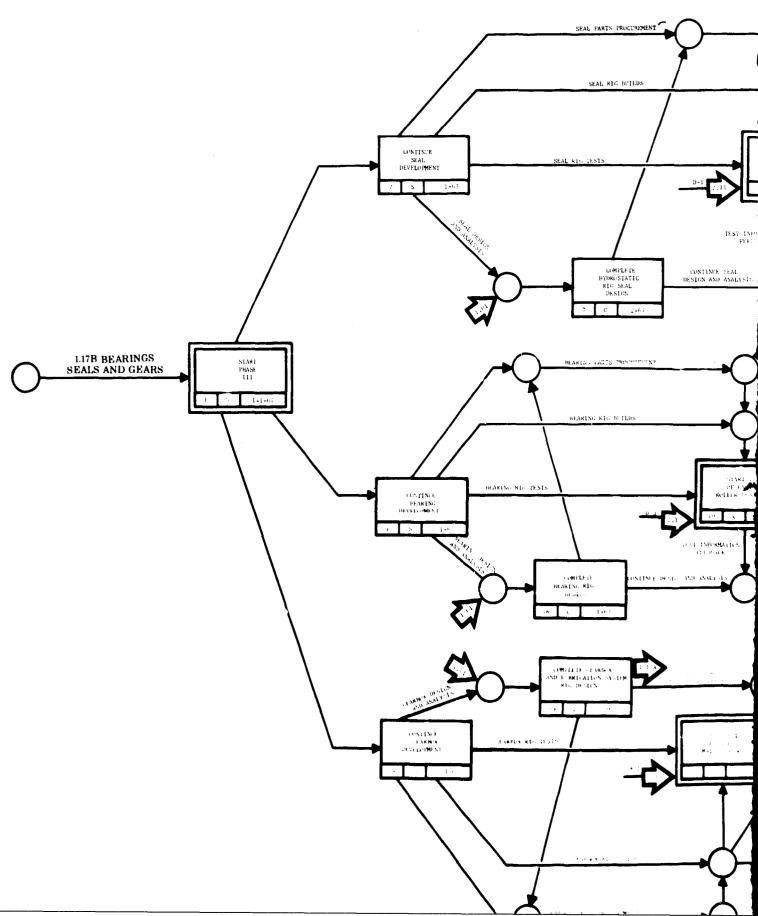


Event Norther	Description and Criteria	Event Number	Description and Criteria
	START PHASE 111 Start of Price 111. Phase III gesthead received from EAA.	8	STARL COMPARIMENT RIG ENDIRANCE TENTS MARE discarding test of specification labeliages in organic computation rig. Rig delivered to test.
•	COMPLETE GEARBON AND DIRE SYSTEM RIG DEPICE Compacts design modification of engine parts for the use. Design additional on drawings released.	ч	START ENGINE ENDORANCE TESTS AT CREASE CONDITIONS Reference engine notwork 1.06 for description and creatories.
	CONTINUE RIGHTENS OF SPECIFICATION LUBRICANTS CONTINUE distin Service tron testing of appendication information testing of appendication scannisted engine completions. These III gosdical received from FAA.	10	STARY LUBRICANT SYSTEM RIG ENDURANCE TESTS Sout control during that to be specification below and functional system. Right south and engine mission by the conditions Rights that the test.
•	START LIBRICANT LESIS OF ENGINE COMPARIMENTS SLITE INITIAL design suchs tion texting of specific, tion labercarts in cognitic compariment risk. Big delivered to text.	11	CONTINE LABORATORY SPECIFICATION TESTS OF LUBRICAN S CONTINUO OF SECTION AND TOWN TO THE TOWN ON SECTION OF SECTION AND TOWN TO.
,	START LUBRICANT TENTS OF ENGINE BEARINGS STATE INTERAS ASSESSED RESECTION TEST OF SPECIFICA- TION DEBUTARTS IN BOATING TENT FIRE RIG delevered to test.	42	Print III g sets to be a read to se EAA. Compare to be to A. The set of the tention Contract to the print of the booking colores to a set of the set of t
n	STARL PURRICANT DESIRATE OF ENGINE GEARBORES STARL PURLIAL SESSION Selection test of Specifical- tion independent on comme periphoses, nearboxing decivitied to test.	11	Principal Day and additional of the Data. SAME Therefore Principal Confidence of Conf
	STARL TURRICANT SYSTEM TESTS STATE IDITED COOKER SCIENTING INDIFFERENCE OF THE TESTS OF T	14	Right Control to the Control of the
			Magnical exect to text

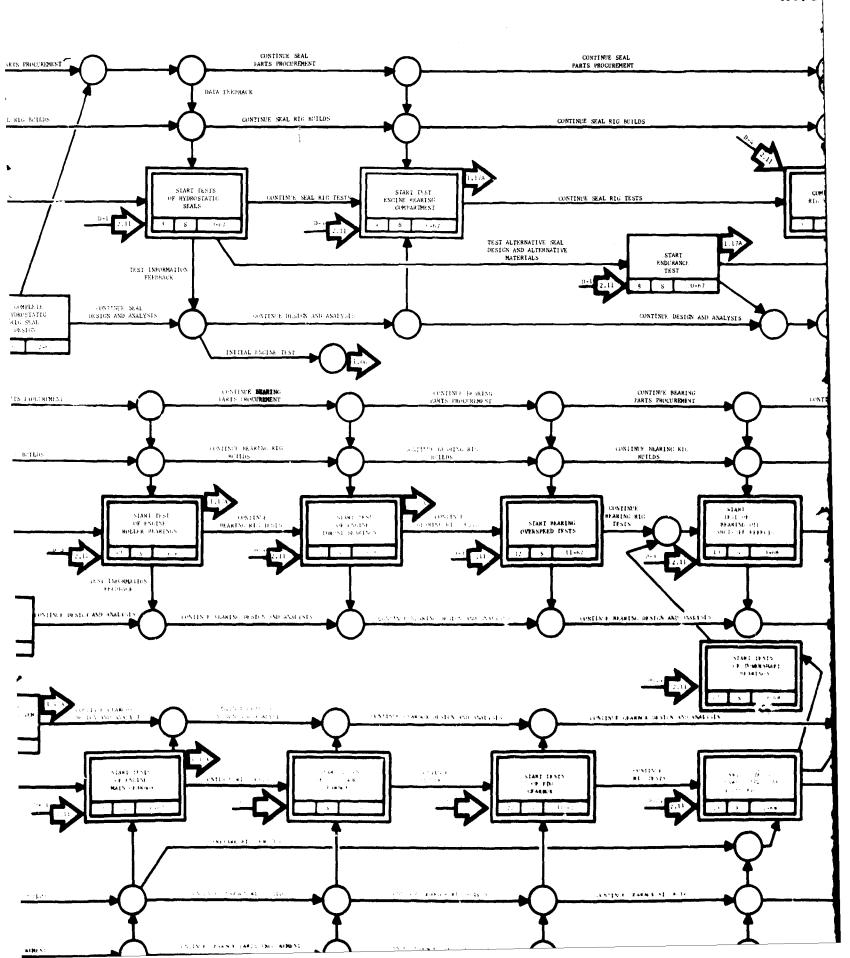




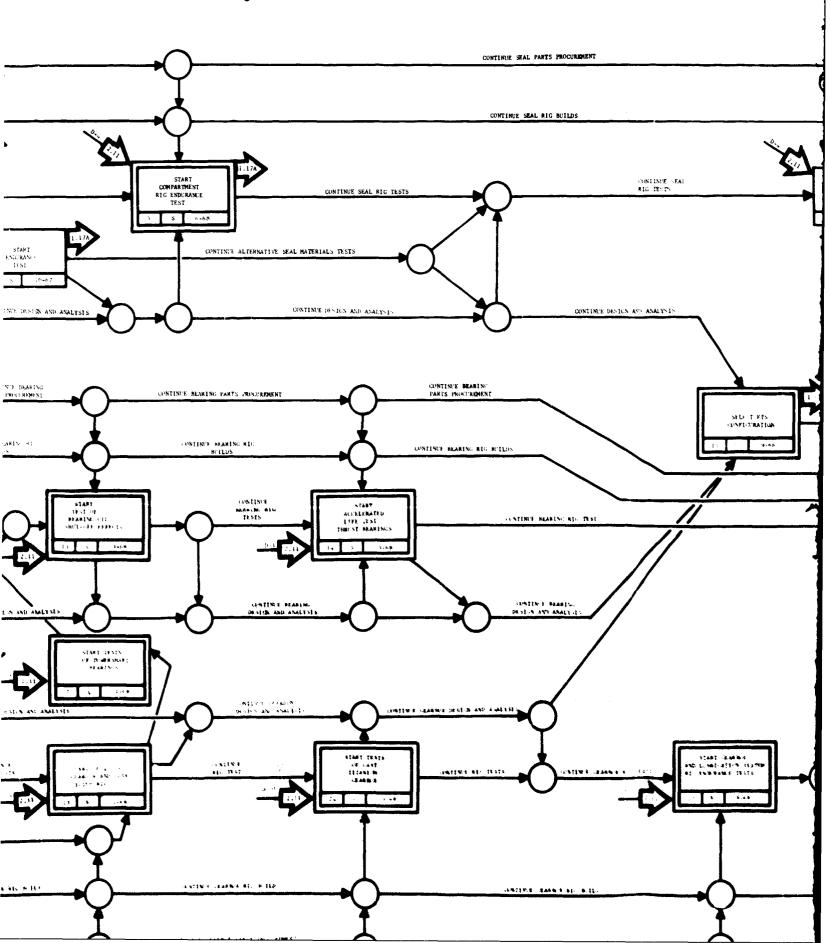


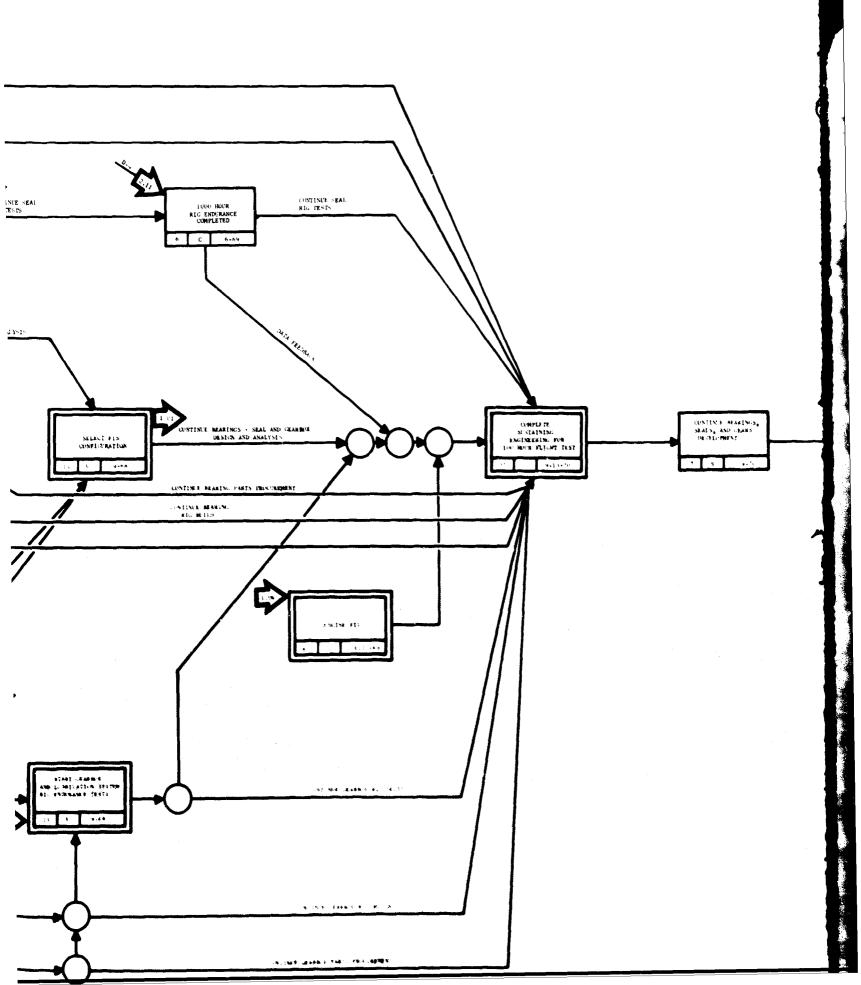


1.17B

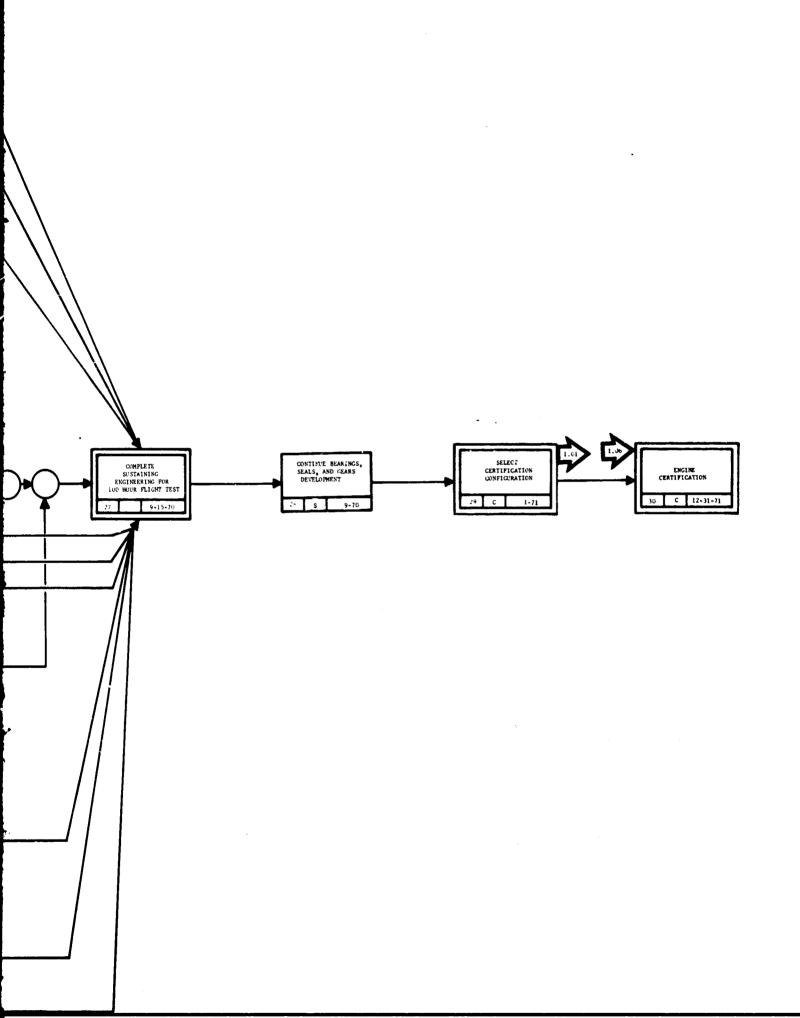


1.17B Bearings, Seals, and Gears









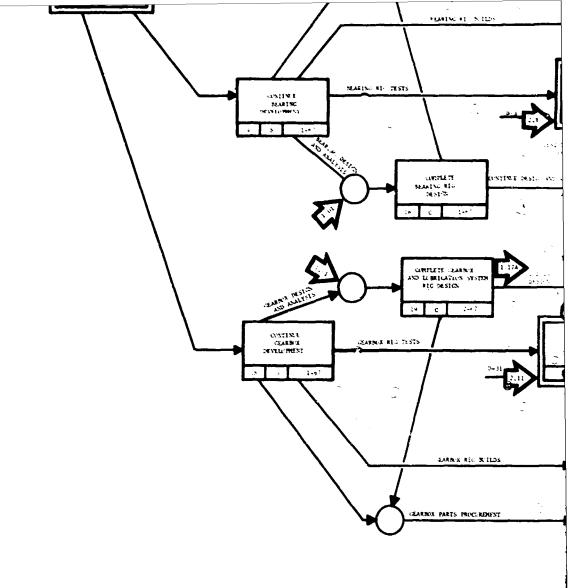
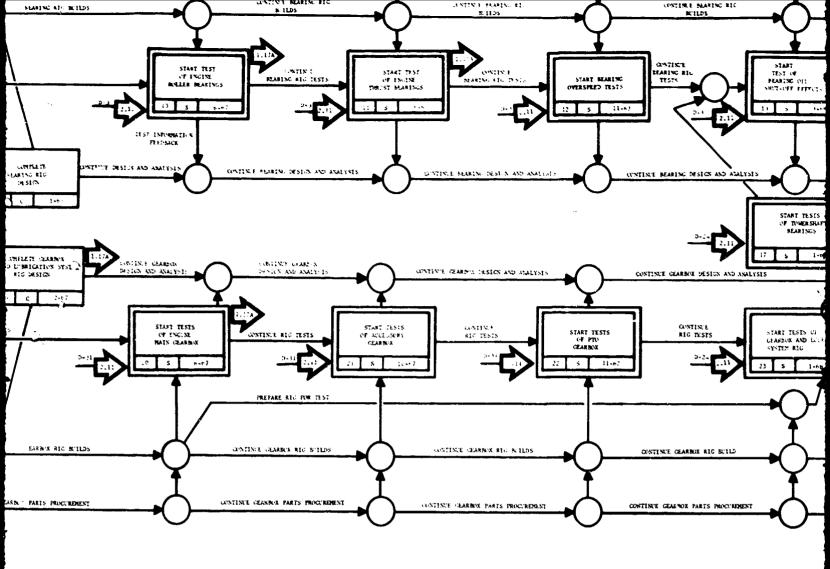


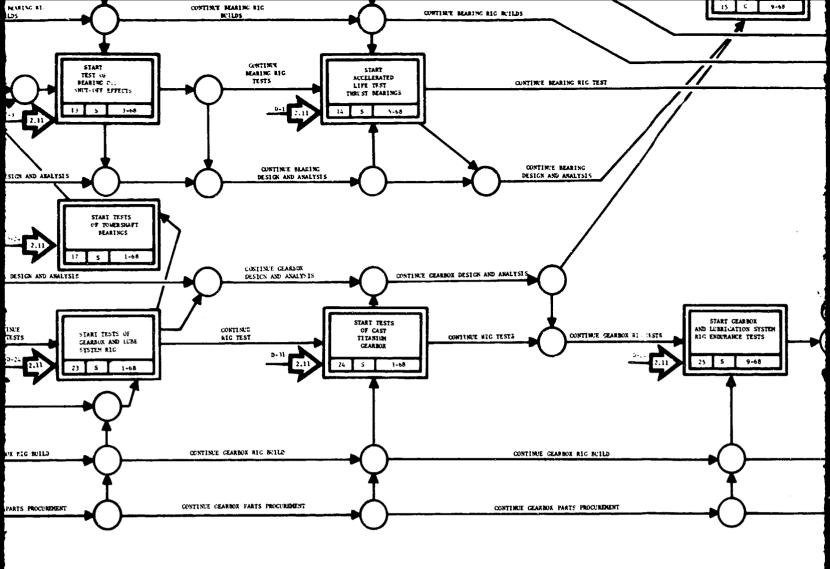
Figure 34. 1.17 Lubricants, Lubrication System, Bearings, Seals, and Gears (Sheet 2 of 2)



		SIARL PASS III. State of Pass III. Pass III acres in proceeding FAL.	10	STARE TESTS OF ENGINE ROLLER Posture design selection test scare rotter bearwas at si- olic, a and rot respond conduct
		CONTROL SERVICE COMPRESSOR CONTROL CON		deliner dite test.
		South Crass III is a said received the TAA.	* 2	STARY TESTS OF ENGINE THREST. I struct besides subjection to st
	§	HART CONTROL OF SUSTAINCE SEALS		to at Bearings at Sin Later (
		Initial his session to start a region		g is not on speed conductioning of
		that data season Repositioned to test.		test.
	•	SINKL IEST OF FROME DEARING COMPARIMENT	12	STARL BEARDAD CAERSPEED RES
		start consent standonal tests of course bearing		Start and old forces started
		part ends in so part entrie at an entration of the second transport of the second discounted to test.		agreed conditions. Rise so a co
			1 4	START TEST OF BEARING OIL SEA
	•	STABLE COMPARIMENT REGULARD RANGE TENTS		Statt instal bearing (2) 6
		start digitalises test is the gave bearing as we		determine the bearing relief.
		particles and partient searched at solution		(i) a stotetis, Recording or
		recipie conditions. To picture on certain Souther		
		and out de two selections and select tail tests and the delibered to test.	1.	START ACCELERATED LIFE TESTS
		and the definition in test.		Statt instial threat beating determined the section of the section
	6	FORMATION ROSERS FIND RANGE CORPULTE		to test.
		Complete that marked throughout a rightly to		11 11 11 1
		test of selected energy to part out a learing	1 -	SELECT PTS CONFIGURATION
		s partient seal right signated concents as no		Schotten it the beatings, se
		+ to 10 S.		 continutation to be used in T
		to eletion of codingno test,		Confliction of design of board
	:	Control Page 1989 to the Control Page 1989 to		 coather configuration to be
		COMPLETE BYDROSTATIC SEAL RIG DESIGN		test age
		Complete detailed inserts not tabrication of the parts. Detailed layers approximated.	16	COMPLETE BEARING RIG DESIGN
		to parts, betarite that ets 411 acreaste,	10	Co glote detailed baseds for
	8	START EMPURANCE TESTS		ing parts. Detailed layouts!
		Start donable to tests of rach badrostatic sec-		
		dealer at si dated covering assignments conditions.	17	START TESTS OF TOWERSHAFT BEA
		Instead dexign whereous plate and ing deligated		leit al structural test el e-
		le test,		beirings at similated engine.
•	14	AND THE RELEASE AND A COMPANY		and culting contigoration. Ri
	"	CONTINUE BEARING DEVELOPMENT Continue the development of the ancine bearings.		CONTUNCE GEARBOX DEVELOPMENT
		Plass 1(1) you alread from Late the the profit rogs.	1.8	Contains the development of t
)		to one ter two one are received that DAG		Phase III go-ahead received t
ars				times. 112 B. miran lettering
l .				

Event Notice

S.cnt Number



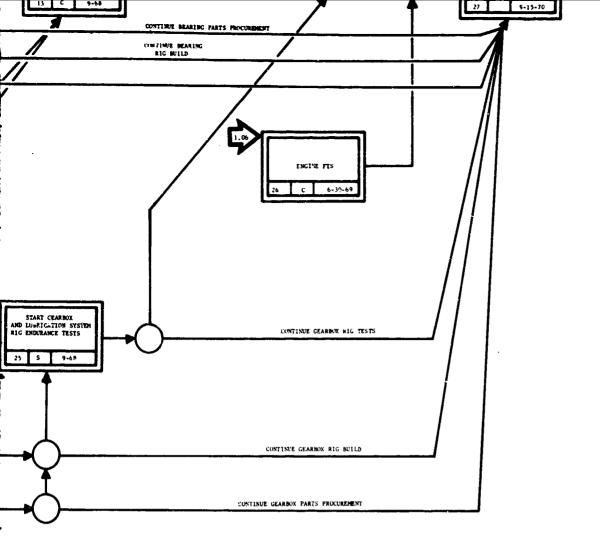
EVENT DICTIONARY

Description and Criteria	Event Number	Description and Criteria	Elernt North t
START TESTS OF ENGINE ROLLER MEARINGS located lesion selection test of course from short rocket hearings at 40 plated course loads, origin, and ref is speed confittings. Big	19	COMPLETE GEARBOX AND INSPICATION SYSTEM RIG DESIGN Complete detailed sodification of engine parts for the ose. Design is diffication of awaings released.	Ç+
delinered to test.	20	START TEST OF ENGINE MAIN GEARBOX Instrum structural test of tabricated titanium	
START TESTS OF ENGINE THRUST BEARINGS Initial design selection tests of engine app		engine main geather. Rig delivered to test.	40
the state of a second constraints. The second constraints and a terrapeod constraints. But delicered to test.	n	START TEST OF ACCESSORY GEARBOX Definal structural test of tabricated titudium ongine accessory gearbox. Riy delivered to test.	
START MARING OVERNIERD TESTS Start restrai Searing Street out tests at ever- speed sendations. Regularizated to test.	\mathcal{D}	START TESTS OF PTO GLARROX Start initial structural test of tabricated tituming employ Power Takeoff gearbox. Rig defivered to test.	
STAFF TEST OF BEARING OFF SHIPMER EFFECTS Staff Politial bearing off so toff Cars to determs the bearing reliabelity and a furtion of oil Staffits. Rie delivered to test.	26	STARY TESIS OF GEARBOX AND 10BE SYSTEM RIG Start initial testing of the integrated engine gearbox and lubrication system in a "bladelyss" engine rig. Rig delivered to test.	
START ACCELERATED LIFE TESTS OF THRUST BEARINGS Start initial Physics bearing Beild Life tests i detainmenthe bearing reliabilities. New delivered to test.	24	SIART TEST OF CAST THANUM GEARROW. Initial design melection test of a cast titanium gearbox. Rig delivered to test.	
SELECT FIS CONFIGURATION Selection of the bearings, scales and gearbox continuation to be used in FTS engine test. Completion of design of bearings, seals and gearbox configuration to be used in organic FTS testing.	25	START GEARBOX AND LURE SYSTEM RIG EMBURANCE TENTS Start initial durability tests of the engine goar- box and lubrication system in the integrated gear- box and lubrication system rig at simulated engine distinct cycle conditions. Rig delivered to test.	
COMPLETE SEARING RIG DESIGN Complete detailed layerts for labrication of the parts. Detailed layerts are released.	26	UNGINE PTS Reference engine network 1.06 for description and criteria.	
START TESTS OF TOMERSHAFT REARINGS Logical structural lost of engine towershalt bearings at simulated engine loads, altitude, and oiling contiguration. Rig delivered to tost.	27	COMPLETE SUSTAINING E.GINEERING FOR 100 HOUR FLIGHT TEST Compretion of cogineering effort necessary to support first 100 hours of flight test. Com- pletion of 100 hours of flight test.	
CONTINE CEARBOX DEVELOPMENT Con that the development of the engine gearbox. Phase III go-shead received from FAA.	2 M	CONTINUE MEARING, SEALS, AND CEARBOX DEVELOPMENT Start Phase IV hearing, seal, and gearbox development in a program continuous from Phase III.	

Description and Criter

SELECT CERTIFICATION CONFIGURATION Select design of bearings, soats, to be used in engine certification pletion of design drawings of bear and gearboxes to be used in engine tests.

ENGINE CERTIFICATION
Reterence engine network 1.06 for and criteria.

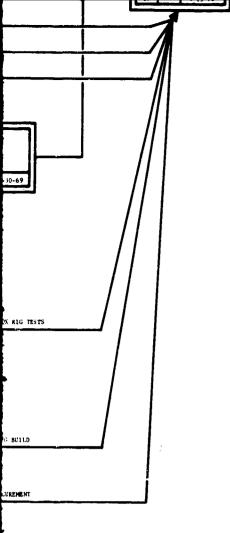


Description and Criteria

SELECT CERTIFICATION CONFIGURATION Select design of bracings, scales, and gearboxes to be used in oneine certification test. Com-pletion of design drawings of bearings, scales, and gearboxes to be used in engine certification tests.

ENCINE CERTIFICATION
Reference engine network 1.00 for description and criteria.

9-70



FD 17637 VH

10

Pratt & Whitney Aircraft

PWA FP 66-100 Volume V

1.18 FUELS

The fuel development program will continue to be directed toward the evaluation of the fuel specifications for the JTF17 engine. Commercial aviation kerosene will be used and testing will be accomplished to determine the adequacy of this fuel. Coordination will continue with the airframe contractor, airlines and oil companies to ensure the acceptability of the fuel specifications.

Testing will be conducted at simulated operating conditions in the JTF17 engine and primary combustor rigs to determine the acceptability of the thermal stability characteristics of the fuel at typical engine system heat rejection levels. This testing will also determine the effect of the fuel luminosity on the combustor and turbine sections of the engine. Materials erosion and corrosion tests will be combined with the turbine development program to determine the materials and coatings necessary for long periods of operation. These tests will provide guidance for acceptable fuel sulfur limits.

Lubricity test methods will continue to be investigated using fuel at temperatures to be encountered in the engine system. These tests will be correlated with component experience to define the lubricity of commercial aviation kerosene.

The major milestones, network chart and event dictionary for the fuels program are shown in figures 35 and 36, respectively.

A detailed description of the fuels program is presented in the Test and Certification Plan, Volume III, Report E. Test planning and integration is presented in Test, Volume IV, Report E.

Pratt & Whitney Aircraft PWA FP 66-100 Volume V

FD 17878 VH

1 Fortame 1 1 to 5 Composite to the state of 1 Fortame 1 1 to 5 Composite to 1 Fortame 1 1 A S Composite to the total S Composite to the state of 1 S Composite to 1 S Composite to the state of 1 S Composite to 1 S Com 1971 1970 1969 1968 1.18 FUELS DEVELOPMENT SCHEDULE 1967 4. NATERIALS LABORATORIES VEHDOR FACILITIES CONFLETE ENGINE MEAN OR JECTION TESTS AT CRUISE CONDITIONS START EXCINE TESTS WITH STREAMED ALBERDARE FUEL SYSTEM CONTITY SYSTAINING ENGINEERING FOR 100-HR FLIGHT TEST START ENGINE MEATED FUEL TESTS AT CHUISE CONDITIONS CORPORNT TEST STATO A-11 2. ALTITUDE TEST FACILITIES START HEATED FIRE TESTS OF FUEL SPIZILES CONFLETE MORLES-LEDE FUEL QUALITY SURVEY 1. SEA LEWEL TEST STANDS START MINICH-WIDE FURI QUALITY SURVEY START ACCILERATED FURP MEAN TESTS CONTINUE FUEL SPECIFICATION TESTS CONTINUE PUEL CONTR TESTS

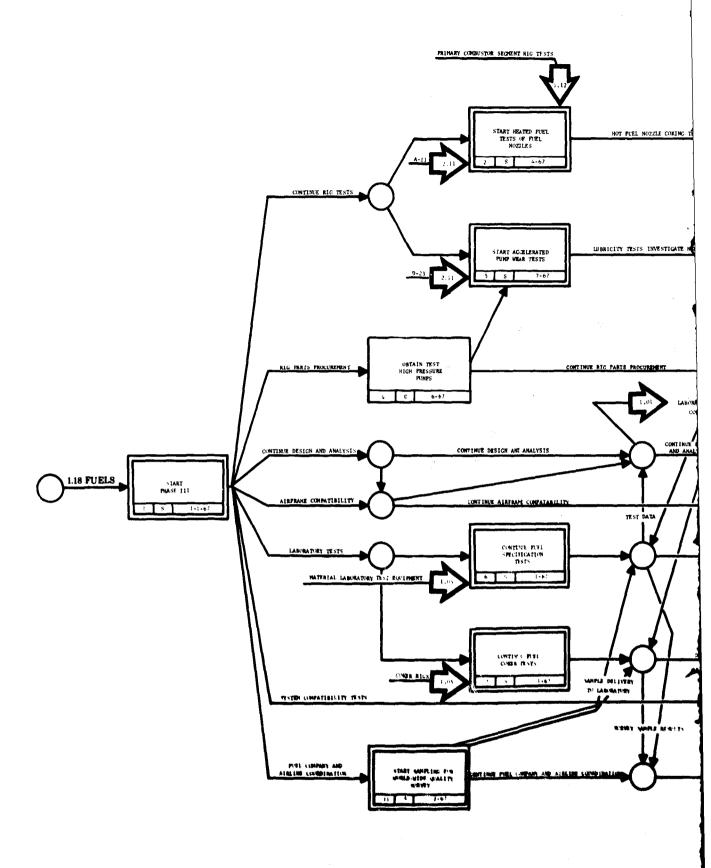
Figure 35. 1.18 Fuels

STANT PRASE 111

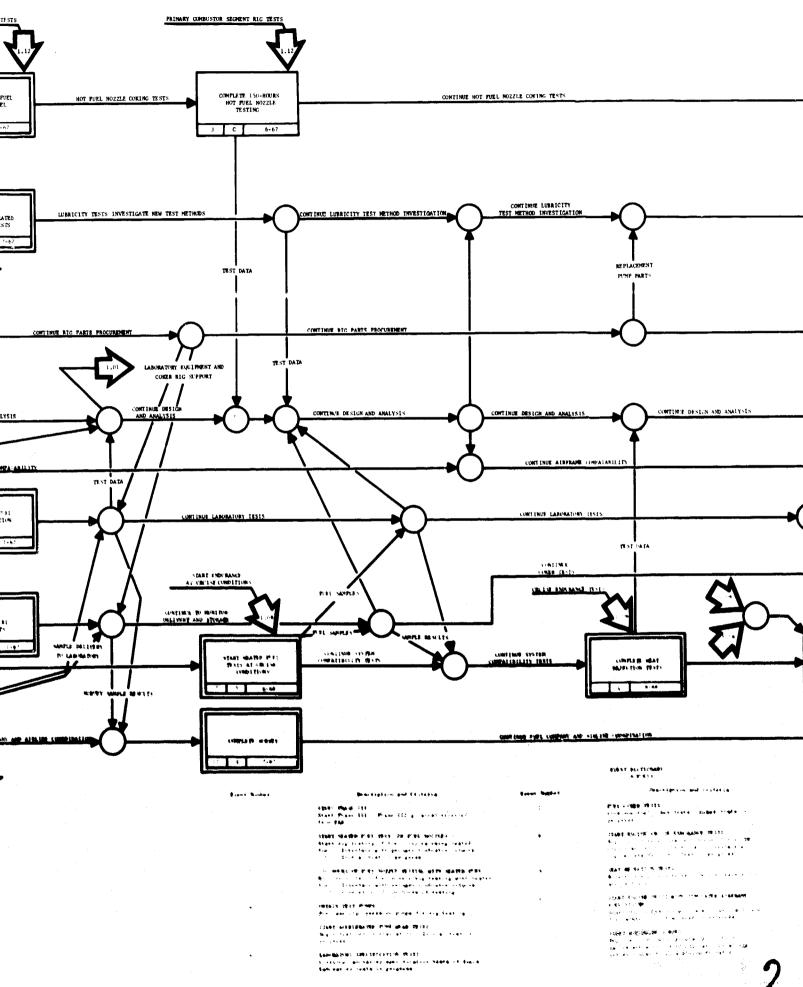
MILE STORES

PACTLITIES

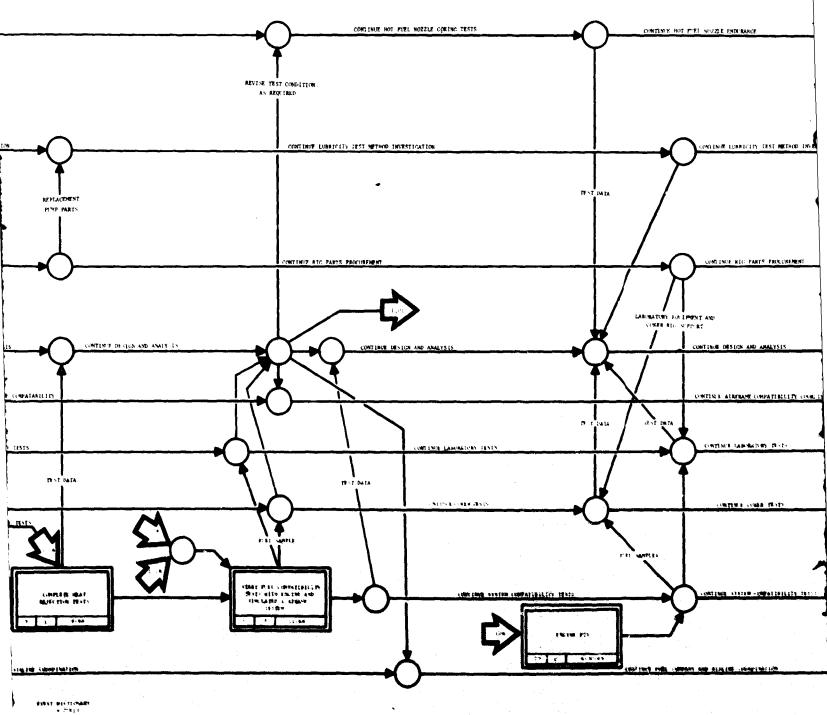
ENCINE CERTIFICATION



1.18 Fuels



1.18 Fuels



. The definition of $(x,y) \in \mathcal{A}$, where y

person a compart of the first of the control of the

entral control of the control of the

START BY A THE CONTRACT OF THE

parate are re-section

And the second of the second o

product of the the second of t

B A B. . S . . .

Busingeria and business

marit de 1 dete .

The many of the second many of t

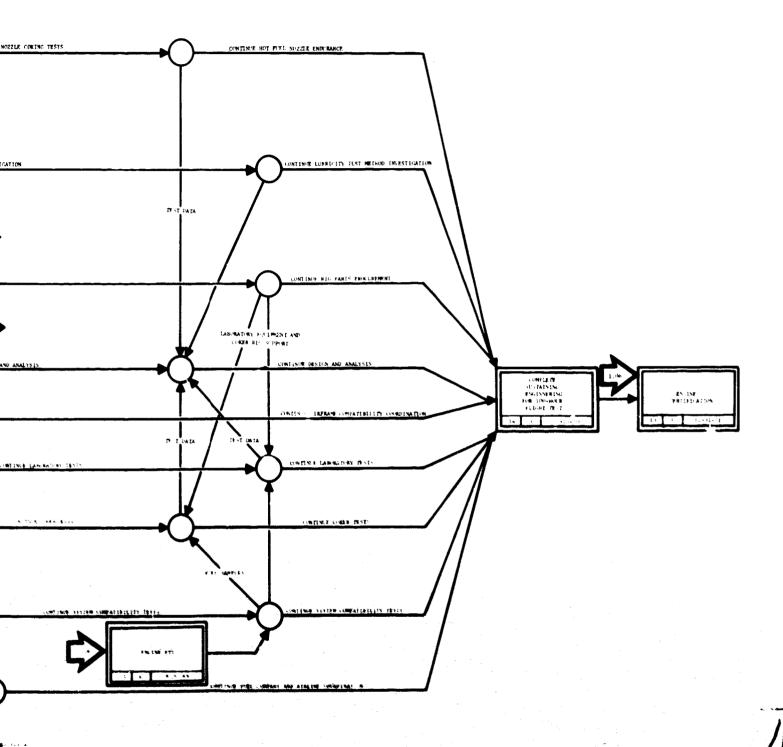
Accessor of a

・・特別の表示をしていることがあり、単元の「大学を表現された」をは、ことに対象をましていることができます。

en de igentificação

Martine a grant see de la company de partire de la company de la company

7



FD 17657 VII

PWA FP 66-100 Volume V

1.19 MANUFACTURING TECHNIQUES AND MATERIALS

Long and short time mechanical property eva uation on materials specified for the JTF17 engine will be completed by the end of Phase II-C.

During lase III major effort will include upgrading the mechanical properties of engine hardware components through the development of improved metallurgical processing used by our suppliers of raw material and finished parts and by our Manufacturing shops.

The Materials Development Laboratories will provide support to the manufacturing shops in the development of metallurgical processing, and work directly with the suppliers of major finished parts in solving manufacturing problems and developing improved processing techniques.

Once improved processes have been established, process controls will be instituted at each step so that the highest order of reproducibility of the final product will be attained for engine reliability. Such reproducibility of manufacture also results in lower product cost due to reduced rework operations and lowered scrap rates.

The Material Control Laboratories together with the Vendor Quality Control group will ensure that established process controls used by suppliers are followed on major parts through resident personnel stationed at the supplier's manufacturing facilities.

Metallurgical investigation and analysis of engine failures during development of the JTF17 engine will be performed to provide basic information for the improvement of materials leading to desired component integrity and reliability.

Major activity will also include the effort to develop new materials and processing of hardware components to meet the engine performance objectives and provide engine growth potential. Specifically, development will be directed toward materials which will afford weight saving, extended service life, and increased operating temperature capability. Strong emphasis will be placed concurrently on analysis of material characteristics which affect producibility of hardware in consideration of the economics of production.

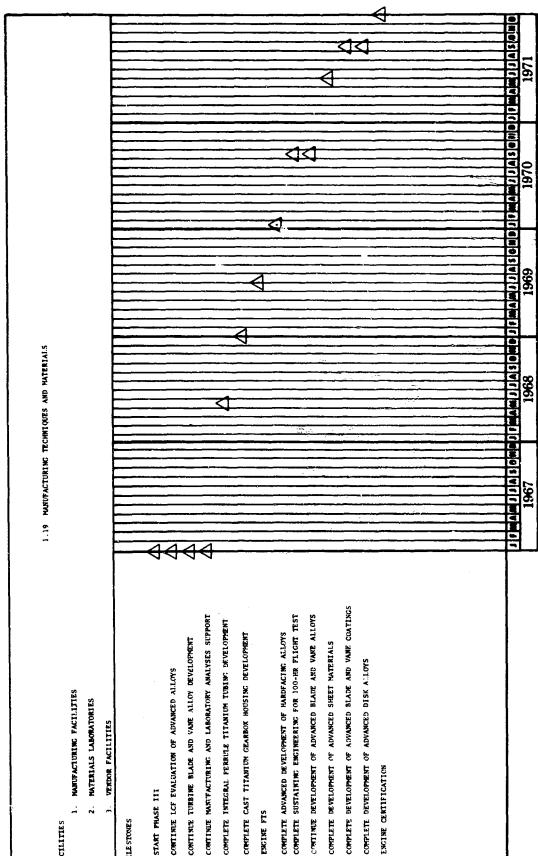
Advanced materials and processing technology acquired on the J58 engine program will be applied to the development of advanced engine hardware for the JTF17. This work has been discussed in Manufacturing Techniques and Materials, Volume III, Report F.

The major milestones, network chart and event dictionary for manufacturing techniques and materials are shown in figures 37 and 38, respectively.

Test planning and integration is presented in Test, Volume IV, Report E.

Pratt & Whitney Aircraft PWA FP 66-100 Volume V

FD 17879 <u>=</u>



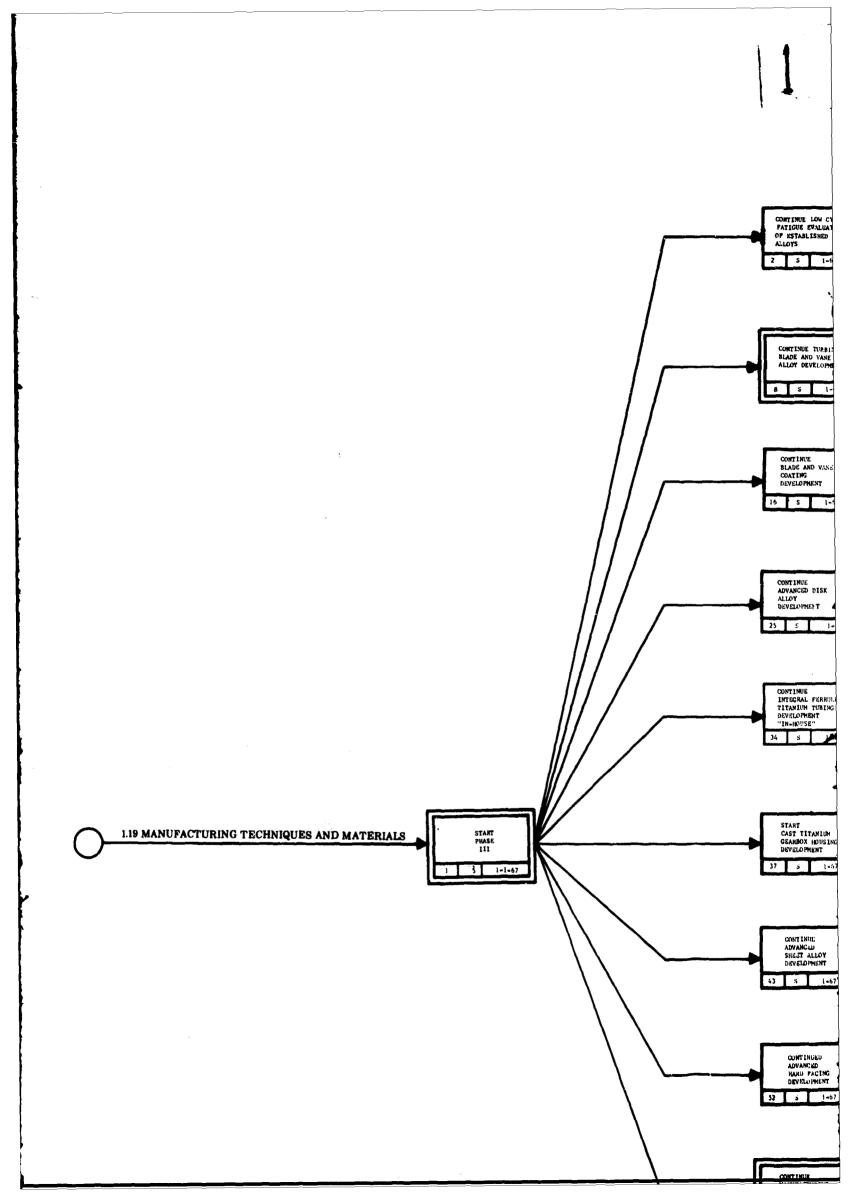
•

Figure 37. 1.19 Manufacturing Techniques and Materials

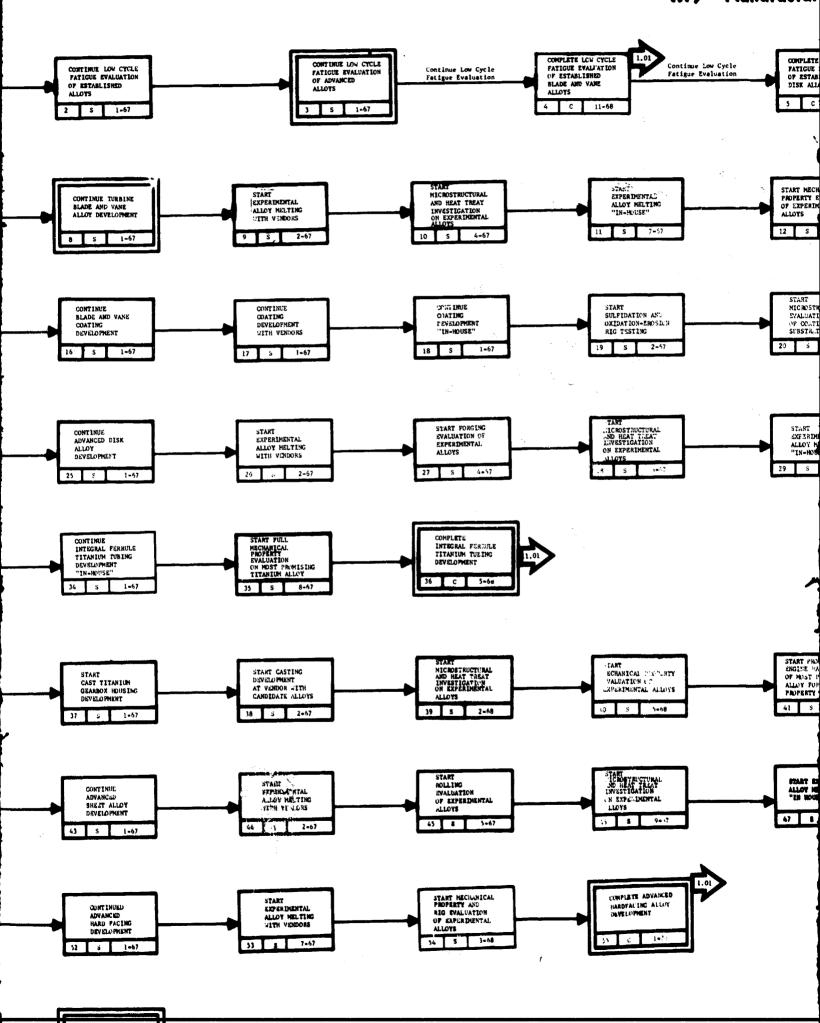
EXCINE PTS

MILE STONES

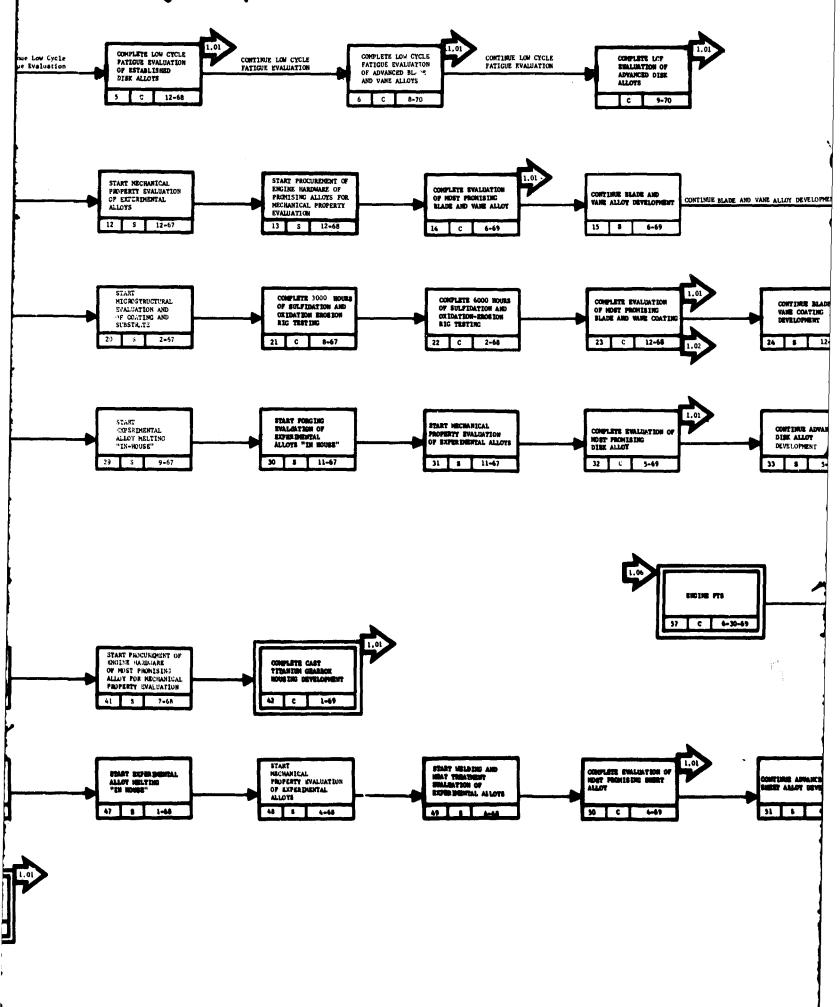
FACTLITIES

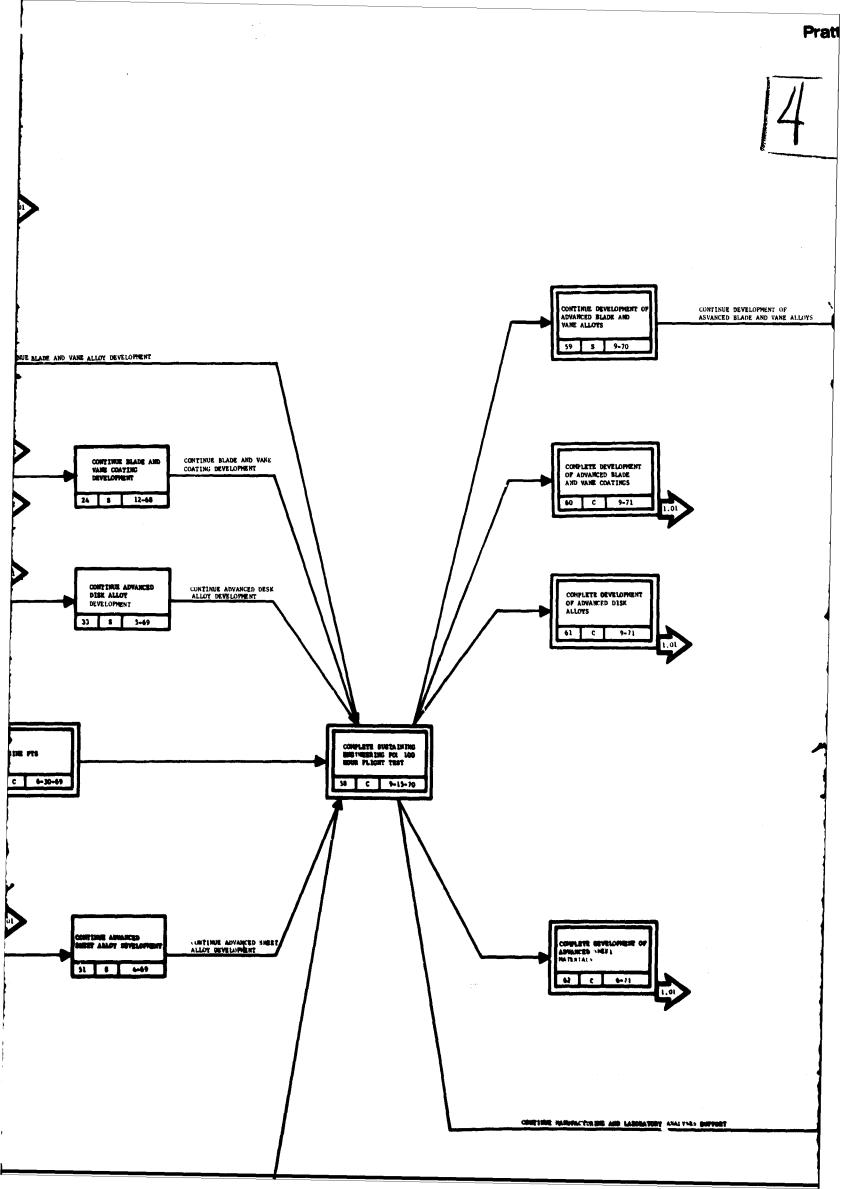


1.19 Manufactur

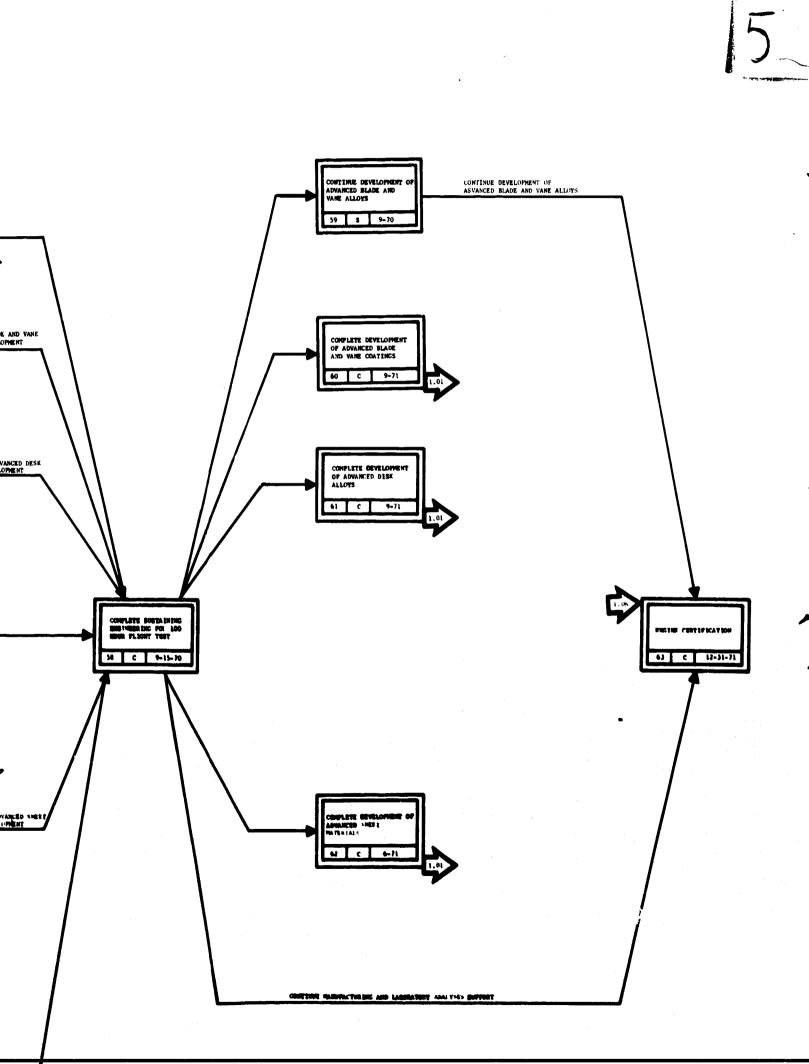


9 Manufacturing Techniques and Materials





PWA FP 66-100 Volume V



START PHASE 111 1.19 MANUFACTURING TECHNIQUES AND MATERIALS 3 1-1-67

Event Number	Description and Criteria	Frent Number
:	STARY MASS III Conserver Plans III Materials Development Propras. Phase III gordhead.	•
;	CONTINUE LOW EVALUATION OF ESTABLISHED ALLOWS COntinue Laborators LEF statistation of variableshed allows for JTF17 rugging. Laboratory evaluation to progress	11:
1	CONTINUE LCF EVALUATION OF ADVINCED ALLOWS Continue laborators LCF evaluation of advanced all we for JTF1' engine. Laborators visitations. to progress	tt.
•	CHARGE LEF EVALUATION OF STABLE GRO BLANC AND VANS ALLOYS	
	Combine properties ICF mealingstors of metablished 1991 his logic and course attention beared on the his world of and course his manifestion. Between results to the beared by the high beginner to course the beared on the beare	1;
*	epita nels abut takes by sorteing by the standard but the supposed butter to be not the top top by the supposed by the suppose	
	21917 deus allere based open medianical frat ers eoleg and streopencesent reaminations. Belones reactes to Brasen Engineering.	
	COMPLETE LET QUALITATION OF ADVANCED STADE AND MADE ALLEYS	
	Combot a comparation LCF invaluation of independed blade and came allogs bearings upon mechanical test towards a particular and bicomparation of the frame evanitation for the first and continuities. But income evanitation for the first firs	16
.	CONSTRUCT STATEMENT OF ADVANCED BLOC ALLOYS Conduct comparation LCP evaluation of advanced	
	diek all-verband open medantral tool receits all misrostreed eminimation. Bricane tendits to besign Engineering	15
•	CONTINUE SCHOOL BLASS AND UNIX ALLEY SEVELOPHENT Continue alley development program alord at tapproved roup arough, national and self-day time reststance for JUST 2. Rechanical and	le.
	physical property evaluation in progress.	14

Description and Criteria

START EXPERIMENTAL ALLOY METTING RED STRUCKS Start molting of experiental or protocolar ad-at lagriced blade and one office capatisists. Place orders for processing.

START MICROSITE OF MALE AND THAT THE CONTINUE OF EXPERIMENTAL ALLEYS.

Start heat treating and to brate of the symbolic of continues and other process. At the start of the symbolic and the start of the

START EXPERIMENTAL ALLEY MELETISE TENDERS SET Meter welling of experimental composed. A length of the lab pattern without a long to well the second of the s

NEARS RECHARICAL PROPERTY PRACTICATION OF ESPERT MANUAL ASSOCIATION STORY SUPERIOR AND THE CONTROL OF A STATE OF A STATE

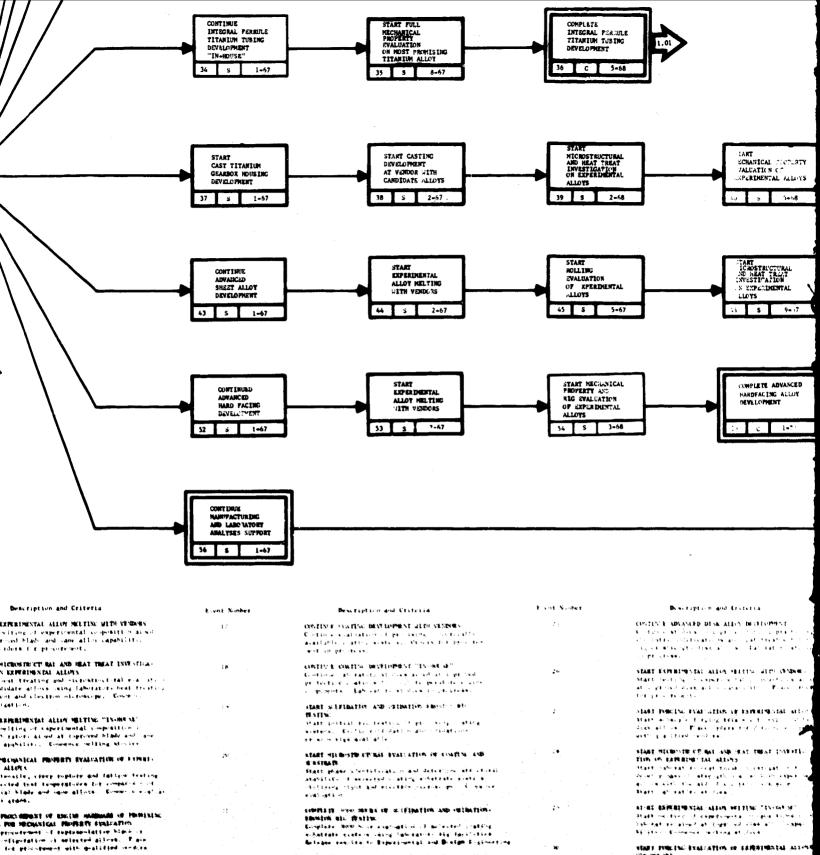
START PROTESTINGS OF STALLS CARRALES OF PROSESS ALLEGS FOR PETRATICAL PROFESSY STALL ATTEN-START STARLSTONE OF SERVICE STARLSTONE CONTROL OF CON-comer annihilation of a control of Control of Con-ceptors of the processor of the control of Con-ceptors for processors with a profess which as

CONTACTS EXPAINATION OF MIGHT PROPERTY. CLASS AND MAIN ALLES.
COMMINGS COMPLETE INSTANCES AND AND AND ALL SET ON I DESCRIPTION OF THE PROPERTY ATTACKS AND AND ADDRESS AS A PARTY OF THE PROPERTY ATTACKS AND AND ADDRESS AS A PARTY OF THE PROPERTY OF THE PARTY OF THE

CONTINUE STATE AND TANK STATE SECTION OF SECTIONS CONTINUES OF SECTION OF SEC

CONTINUE SAME AND NAME CONTINUE MEMORPHMENT Continue Inducation candidates, excellent and and then treating of continues blade and name continues Williams and name continues with the participal organization of progress.

Figure 38. 1.19 Manufacturing Techniques and Materials



complete direct ments of all figuration and outlinesses benefiting the first of the first section of the first sec complete de describents de grapomentos dels implementos benedicos describentes. Escribentes de describentes de substitution of most productive state and VANE CHAPTAC:

Empirate laborates into emissionemalal tenting if
meal georgaling signing ariston for ETES Night
and income alling. Bulgado sepilato and encommenda-siona se Bappaliania and Braign Engineeding. VANE CONTING chartens means are take control services by the Continue of a constraint of and of constraint and and all and of constraint and and constraint of percent applicables for JETT application. Be one temporal and of circumstation of constraint of and circumstation of constraint of and circumstation of constraint of the constraint of the circumstation of constraint of the circumstation of circumstations.

The Bright affilm of which Philipping name and the property of the property of

PE MANN AND TANK ALLEY MYSCAMPET on mechanical and phenical property and should property and should property and special and so of manetall with the capability for 1783? Alade and compatible for so property and property property at an appropriate property.

to make and until confine protestions; to job earlies resident me, execute and as fide-exting of condidate blade and same continue. It' ongine. Substitute analysis in

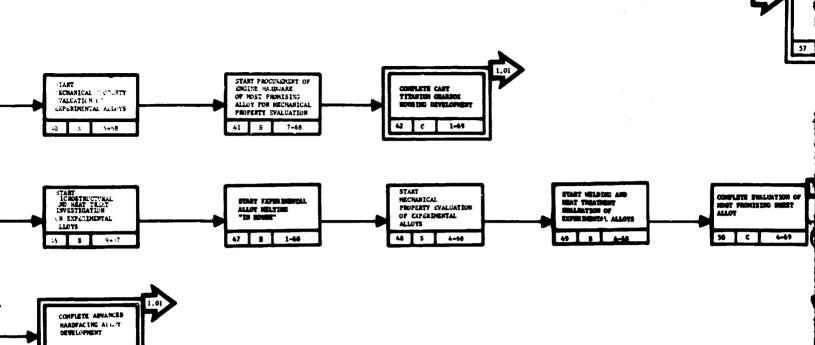
almis tagicijas graficējijas au tiplikaladzijas irrisa.

rigalisak dan Argant in hawipin dilegiriy, ke pilalipiti legandhavi ta dilebi pirina intifikasiy, lebi nadirri hidebiya tai Arabi dilegira devota

atulti mengaticas dinggulti eigsvatism ob sabig. Myttai askuga digas tarbera, eterp e jetuse polici orditer eigsvatism digas tarbera, eterpe eigsvatism die eigspatism die eigspatism of personal discontinuo die eigspatism of personal discontinuo die eigspatism die eigspatism of eigs

compagification of more functions at a construction of a construction in the construction of and phase calls as a construction of the construction of a construction of a construction of the construction of





CONTRACT HAMMACTURING AND LABORATORY ANALYSES SUFFRIEN

Description and Criteria

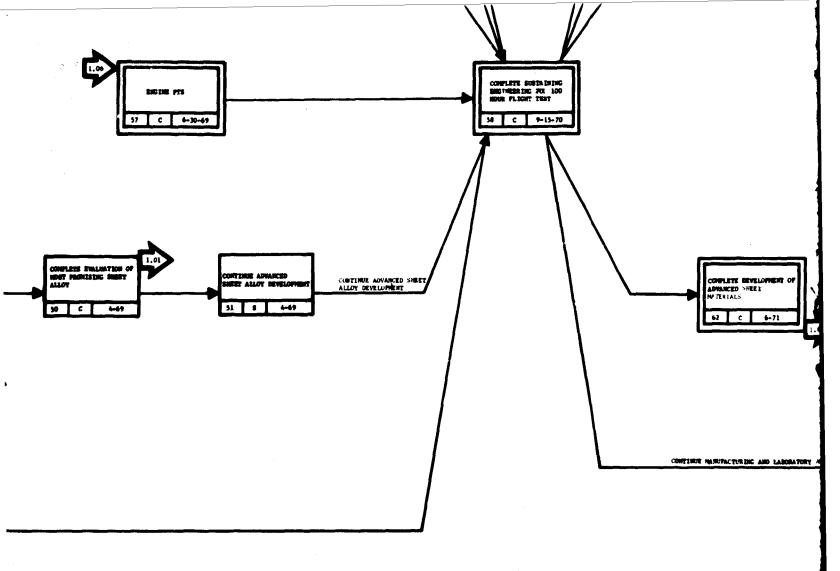
EVENT DICTIONARY 1.14 MARCHACTURING TECHNIQUES AND MATERIALS

g 1=74

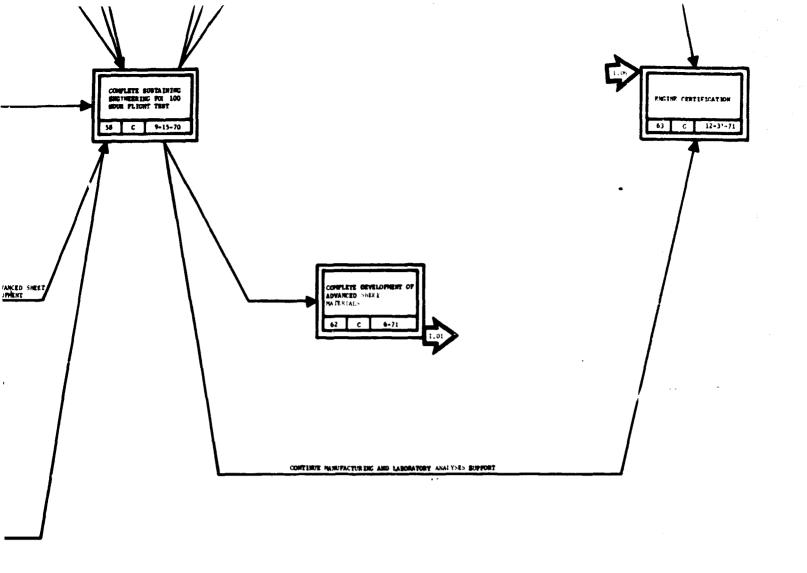
1				PLANT MALE AND A STREET WAS ARRESTED BY CONTRACT OF THE ARREST OF THE AR
CANCED DESA SELECT DESERVATORENT	**	CONTINUE ADMINISTRA DISK ALLOW DEVELOPMENT	4 €	SEART MECLANICAL PROPERTY EVALUATION OF EXPERT- MENTAL ALICYS
to be a first of the second of the second between the second		Confirme cheminter modulicultum programa, im-		Start to mile, tati is, impact and handmean
Fication and eat thintment to		proving forgine practices and echanical property		
ut diam a' a fabitatiti et dien		mentioner over the deals and because where a top course property is a		restring at activitied test temperatures for com-
I -		tor JW1' application. Chevistry, torging and		pas o fige tentidi geathan allicas, tumasum
		herhantial months ton to progress.		tant pt grain
COMENSAS ALTON BETTING METH STANCES				
The company of the first property of the second	54	CONTINUE INTRODUCTION OF BUILDING TO BEING	•	START PRINCIPANT OF ENGINEER SHARMARE OF MIST
the same of a paratrial of these objects of		MARTINGET		PROPERTY, ACTOR DES MESSANDENT PROPERTY
		Continue atualies . hot worthing practices empt. pub.		RAME, ATTOM
i .		in producing comit, h attempt integes t time		abaco paris is sent. If terrescribative geathing
THE ROAD ATTACH B EXPENSION STATE WELLSTEIN		treetien mitt ettaren att in Laboratore inime		a retraction of artestal attract Place residence.
Attention of the appearance of the second of		Flants on in program		gine gert bermebe matt gichlichtent immeliebe
to Place pusse for felicine at disks		and the state of t		
44 47	**	TABLE TO A STREET OF THE PERSON AND A PROPERTY OF THE PERSON OF THE PERS	*2	COMPLETE CALL TERASTIN CHARMS WE LESS BEST COMPLETE
	**	ANIMATER AND ANIMATICAL AND ANIMATED BANKED AND ANIMAL ANIMAL AND ANIMAL ANIMAL AND ANIMAL AND ANIMAL AND ANIMAL AND ANIMAL AND ANIMAL ANIMAL AND ANIMAL ANIMAL AND ANIMAL ANIMAL AND ANIMA		ting ate milianceal geogrees and obstrattant to
THE T ALL AND MAY THAT ISSUED TO				and de n fingue bildang, balling ged be-
ing the state of t		Start terails fatigue and butan quarters of the		dere mart es du finantunt if vonting proctices
		think printering bikantum atten at batauted bent	* *	fig. stander aller graffent bereitige. Merenner
rang ar in nam ning all agrand tagation of the		to special class to extendion the copercion of the		eas the and her moundations to between and
e in the second of the second		all is Communit to at paragraphy		Base and the Brance thing and the Company of the Co
A CAN COLL LARGEST SECTION SECTION OF THE COLL COLL COLL COLL COLL COLL COLL COL	_	the control of the co		Bellin a sur et de Build avenagen e
41 1 41 Jan	S	constitute factories nome in 12 per ton to the first		CONTROL ADVANCED WHEN ALLES MERCHANT
I		and freezes	• •	THE COURT OF THE C
nicklate mertem Ligenen im.		Comptibbe muchignaget gengunte gieb eine febreteine finet		groups at the market bet to be particular.
the contract of the state of th		and ration of titanium allers and the breelinging		दश्यानद्वात्त्वम् । तान्द्रवद्वाद्वात्त्वात्तात्त्वम् कृत्ये । त्वाकृत्त्वम् हृत्याकृत्यान्त्रवेक् हिन्द्रः
Acres 45 . 440 4-2 7544 # 700 04947		of interest for weaking proceives too integers:		Therefore and the second second sections and the second se
The state of the s		fetfele bebing development. Bringe femile unt		15 C (10 C 10 C 10 C 10 C 10 C 10 C 10 C 1
1		ten eiffenehrt eine fo bentem auf Caputtemuta:		
the brain approximate backupfellentent Alexana		Inginousting.	46	start throughter with within the symptom
4 · · · · · · · · · · · · · · · · · · ·		**************************************	the second second second second second	इक्क्ष्रक रिकाल के रहा । वह अवक्रके राजकात है की अन्यक्षित करें के विकास कर राजने
the Freeze or big with completents.	10	WHAT CAST IT BUTTON CRAMME BUT NIVE BETTER BETTER		ga bugge und beige bangubuge, da utwas alb ie eigen:
Tenning ing in earlies diverse Televisione		Matt stratics by the the biblishes subjection in	•	Balling . Bun - Gang fin gene estemb
and the state				
)		refrieden bieg variend, defigie a franchie feligie bei gegeben.		state milita prairation in sentineire et et et
STEAL PROPERTY COMESSION OF FEMALE		findings Einmung läbregtet immunttimttera	- -	tage publica termin care; autorain alah lem te
rativer amakata andrewthen in annual	_	وروزور وراها والمتعلق ووالماهم بعالت المعادر بماهم		mint mampfinnings abare mill e Piete retere
	-	THE CATTING WITCHISCH AT THESE WITE CANDIDATE		Top polition attains with good if you want to
The process of the second of t		alim's		The state of the same and the s
கூறு புரிய சுதியமும் இந்திரும் கூறிய மாழும் இரும் முறு		State in the temperature and development of a course	Section 1	THE PART TARE THE TARE OF THE PROPERTY STREET
- other a type : Cymwrun tret en anni-		provide that will state amond, rappulation, com-	**	
4		pine titantum contingo esticing biless of inferent		OR RESERVOIS ALLERS
presistencia and applicating being visual.		More extent for willing advance with multitled		Matt feat traction and more attention and explosion
ng caka i machiangsi ati i andi ationani ati i adipandan	· ·	undire s		ef emergen ert ne reten fematetet gemt fanet feretore
in news geringe be Boeb will am Bet				eigejagement and wildertein nähenderiger. Gementen ab-
na and decommendaty of the Beauty and	10	THE MICHIGATION OF THE CO. STREET		which signed terms
a Englished ing		OF COMMENTAL ALLERS		· · · · · · · · · · · · · · · · · · ·
î i		that best treation and electrostructural residentials	4)	April gaterialister erfoa afiliar "in me et.
<i>1</i>		of condition (theries allers uping inhersters heat		Milit helfing of pages counts' car carticate un the
4		treating facilities and plactice attackings		interpretation at the contract street active extenden
1		Commiss toward last time.		committee and takeriakeries. Committe mileting
1		Committee (Section 1997)		etuites

Description and Criteria

Lorat Money



ption word Criteria	Lient Munber	Bestraption and Crassesa	Form Number	Descripts of and Crimers.
I PROPERTY EXACUTION OF EXPERT	i.a	START SECONNECAL PROPERTY EVALUATION OF EXPRESS	• .	COMMERCIAL PROPERTY OF THE PRO
		MEN SAL ALLIMY		the contract of the contract of the property of
fattgres sipacit and card eas		start from the steep toplore, figure a me best		grande to the contract of the
test term becomes seen to a		tenta in wells tools an teres all nices with an extension		gap can be called the Majoraban data. Halland the communication
The all gratefield as a long of the con-		Property for the prompation of the property of the ex-		growth bearing a hope to the horizontage
*		all in the state trat program		
NE OF ENGINE GARDESHE OF MOST		the same and the s	! •	CONTINUE MAINTAIN PARTY AND LAMBERTAIN ACCESSES.
AND MECHANISTS INCOMES.	• •	START WELDER AND IBAT TREATMENT EVALUATION OF		a rest
and affective time affet		EARTHER MENTAL ALLER'S		and the control of the second second section in the second section of the second section is a second section of the second section in the second section is a second section of the second section in the second section is a second section of the second section in the second section is a second section of the second section in the second section is a second section of the second section in the second section is a second section of the second section of the second section is a second section of the second section of the section o
to trestant table scarce		that theat temeting and rive attrictlying an		in an early of the control Manufacture as
to a seminari da se		the month of the state of the second of the		to be constructed and an arms of presidences.
கிறுக்கது நிக்கிஷன் இரும்புக்கிய இருக்கிய மிறே முது முதிந்துள்ளது.		क्षेत्रेकरि देवके क्षा है। के स्कृतिक देश करेंग्य है अपने प्रमूल देवके देश है ।	**·	-1.5.00
auto (asaturi seria en .		Kommerce Grangebagnbaren,	• • •	Eligibal Fits
than the challeng son about payth suffer of	3-0	COMPLETE BEATCHTEIN OF MINT PROPERTY MET ALTER		— ■ Please a common tale de la seconda (#1988)
van de merét and mar de de la la gara	~			and the section of
And Colden on any one and the		் கொணியும் முறைப்பட்ட கூடிற்கு நடித்து இரும் இரும் இரு இருக்கு இருக்கு இருக்கு இருக்கு இருக்கு இருக்கு இருக்கு இருக்கு இருக்கு இருக்க	50	connecte de statistica enclatación com concesion de
Puffymanant is sauting phases on		Sugar seasing to begin and taken to be surveyed.		at the particular in the state of the state
in graffe et berge . Er ente		reter auftrag at mintfin Bie falle temmin befriebetef.		Recognise many master on a large to eather than a contract typing of
memoration is the source and	31	THE PARTY OF THE P		and the second s
pires + bo a		கோர்கள் இருக்கு இருக்க		hank we gene & water beid the et al.
		ஐம். மட்டி மட்டுக்கு இறையில் உள்ள நடித்து மட்டுக்கும் அரு அவருக்கும்.		the state of the s
Le man anter batte batter and a		erational control where although with their contrading	3.4	control description of Amaginab state and care
a to compare a classificacións		Satisfy for SW1 appropriations. Themselve, t. Clina		M 1175 -
rationer and Arat beinftneren bie		and mylarical of moths did not a in process.	and the second second second	The real of the real grows of a big files and all as yet has any
ufweit ihr Cross - Bigtergation - retuin			1.0	وموجعها الرافاء بالمامونية المحمد المعمالة فالمناطونية
	∓ 4	CONTINUE ADDRESS CAMPACING AND CONTINUES.		and the set appropriate the before the second of the secon
		Continue at higher in advanced hattigating affices		் ஆல் ஒரு ஆக்கள் அதே சந்ரசியும் படத்தி ஓர்க்கும்
in otto destine nile destine		with engineers in the Salthara. College can in		
Transport to the control of the second of th		Equition meaning and and another that the base of	40	efmilite befangeige es ein eine bei befreiß beite folle.
temperature element all a person		givense de akies et de torre apprind. Laberstree		ermith. 2
the entitle by the contract of		at white to be great		الرابي الموران الردام والمرابخ المالية والمعارف المستحدث المالمور المالية والمعارة
				Burgo estant e provincia por america de la la la large cump a la la
to allow or sufficiently every:	* 1	single experience with write alle appears		The material control of the control
Paging vassing authorises along the comprehensive and the Proposition of the comprehensive and the comprehensi		State metaling of eager-mental compraisions about		god regarde later alle Melligian exilities arables.
1) நின்னைன் நடைபடுக்கான இந்துவன் அதன்னைன் பெலக் நடிக்கில் நடைத்திகள்ளி அம்மானில் கட்		at improved tugelfering affine ematelites. Place		Birthan and Baybon merta. Bigli automy
ned Beit. And Sates, commende		addeds for Bank-dament		
Man are want fitter that below the	54	stall mematical flamen ask his evaluation of	4)	* PROPER
ALLENS	•	FEMALUSCHIA ALLEYS		து பண்ணும் இது கடிய இருக்கு இர இருக்கு கொடிய இருக்கு
the man we trateful to the word had now				திருந்தத்து முக்கும் முது தொடிப்படு பிறும் நடிப்புக்கும் புகும் இரிப்புக்கும் நடி நடிக்கும் குடிந்திருந்தில் நடிப்புக்கும் நடித்து குடிப்புக்கும் நடிப்புக்கும் நடிப்புக்கும்
the region abroadles been structure		. Brank Anguat , had hardware and his ware tracting an decimal terms for any first company on all professions		ழக்கு அவக்கு இறைப்படுகள்ளனர். இன்ற கான்ற படுக்கு இன்ற படுக்கு இன்ற இருக்கு இன்ற இன்ற இன்ற இன்ற இன்ற இன்ற இன்ற இது இன்ற அன்ற இன்ற இன்ற இன்ற இன்ற இன்ற இன்ற இன்ற இ
artenda nigerage and Community in		histining aline . Combance foot decarage.		mak Banerii merena. Bir cakeria
Treatment of the same of the s		ाकरणास्त्रा प्राप्ति सारणाच्याः । चरणास्त्राच्याचे । वर्षाः वर्षाः स्वरूपान्तिः ।		Book audicit den der der den generalen 19
IN MINE WILLE, LIVERING,				
entagen ein mannel get in innheren girt fin veren ihm in die der				
at taper-upd abust alter attm.gen				
affication formations of the				



room Seater

ALUATION OF EXPERT	55	COMPLETE ADVANCED GRAPHICATIC ALLEYS DEVELOPMENT (CO.). (C.).	
, fatig a sod Neod ed wiest at befacted t potential wheet are		i produkty i tradicija i privi se spilaviški poveto. Nagodnaviji godini je Medicaba izgani dobinami bio spilaviška. Do se podeniciji se Dogodnici ta drogodnici se spilaviški.	
MENT EVAL ATTIC OF	546	constitute many bangs milital lands damentations assets as	
atter to a give via 'ape est was to like to in and anodationers		(b) the two two sould be used to the annual process of a contract two two first and an in-Mann Part two sources of a contract two sources of the contract two sources of the contract two sources of the contract two sources.	
	• •	Statement Comments of the Statement Comments	
PROPERTY CONTRACT ALLEYS political and property		And statests	
கங்கள் கிறிற்றிக்க கேண்டிகள்கள் கிரும்புகள் மழு	₩	comprises of tractions, the following the coloners Prince: The S Emphrise concrete for a coloner to a figure or growth	
E MATERIANT		Considerate temporates for expendit time mysels, but sight a testing of a property of the contract of the cont	
195 graph of his capacity of the graph of th	19	entering material frames of admissable stade and some appears times a dealer material of the dealer by the life	
物ではなりがなかせ たっきをするいいの。 たっさのできないいなった。		தம் தால்கள் பக்கள் களிப்படிய பட்டிய இரும் இரும் இருக்கள் இரும் முதி தமின் நமின் நடிய இரும் இரு முதி முழி நதிக்கிறையுள்ள இரும் இருக்கு முறி நடிய இரும் இ	
1665 en g. Emeir effe	€	CEMERA DE DESTRUMBENT CE AMPRANÇAD TIAMP AND YANG AND YAN	
) शिक्षाः संबंधित प्रशासक्तिक सम्बद्धाः स्थापन स्थापन स्थापना स्थापन स्थापन स्थापना स्थापन स्थापन स्थापना स्थापना स्थापना स्थापना स्य		Sing is palam to polici and research to 1000 to per make unpalative gloss encource between your solvery modern provide and company controlly a life capable particle wrestern to provide you with the provider to the controller to provide your throughout the following the controller to provide your throughout the following the controller to the contr	
tic traj ation of	4 ;	ermana de deservament de deraktêm mila dilina Completa denomina de delaktêm eti general de delaktêm	
ichlich under tentfolg Simbolichen, of gestandisch tent beligenen		டுந்தத்து ஒருக்கி படியுள் நிறியில் நிறிய நிறிய நாகு நிறிய நாகிக்காற்கிற ஒரு நாகையில் நிறியுக்கும் நிறிய சிறிய நிறிய பிறிய புடியில் இது நிறிய முடியில் நாகும் நாகிக்கும் நிறிய நிறிய நிறிய நிறிய நிறிய இதை இதும் நிறியாரிக்கி நேரு நாகிக்கிற்கு	

Bescripts in and Engersa-

Event Sumber

teria

Descripto a light rick

COMPLETE TO THE STORMANT OF A DAYS CARD SHEET AFTER TO THE PROPERTY OF A DAYS CARD SHEET AFTER THE PROPERTY OF A DAYS CARD SHE

Production sentential to the control of the control

10

PWA FP 66-100 Volume V

1.20 WEIGHT CONTROL AND STATUS

The JTF17 engine weight program during Phase III will be monitored and controlled as follows:

- 1. Report engine weight status and weight changes periodically
- 2. Evaluate all development engine changes for weight effects
- Perform weight reduction studies to evaluate (1) use of applicable weight reduction concepts in all sections of the engine and (2) incorporation of new materials and new fabrication techniques
- 4. Perform weight trade-off studies of alternate designs.

All activities involving JTF17 engine weight control, weight studies and weight records are performed by the Design Weights Group. This group is responsible for all effort involving weights and serves to coordinate activities involving parametric studies, weight trade studies, weight control, weight records and design loads.

Preliminary weight estimates are made for all design layouts and parts weights are calculated from detail drawings issued with engineering changes and experimental parts releases. Weight records are then continuously updated. The weight records system is set up in a manner which allows cross-checking for accuracy. Detail weights are revised for all engineering changes and the engineering change records are periodically compared to the latest Bill-of-Materials parts list weight. Actual weights of received parts are compared to calculated weights and any discrepancies are corrected.

All design layouts are also reviewed for possible weight reduction and recommendations are made to the designers. Other weight savings studies are initiated within the group and all items are coordinated in periodic weight reports pointing out the best combination to achieve a minimum weight engine. These reports are not limited to specific intervals, but are issued whenever significant changes in engine weight deem them necessary. Preestablished target weights for each engine section has been effective in promoting weight awareness and in measurement of progress. Regular reports to the program manager measure progress relative to this target weight breakdown.

The major milestones, network chart and event dictionary for weight control and status are shown in figures 39 and 40, respectively.

A detailed description of weight control and status is presented in Weight, Volume III, Report A, Section IV. Test planning and integration is presented in Test, Volume IV, Report E.

Pratt & Whitney Aircraft
PWA FP 66-100
Volume V

FD 17880 VH

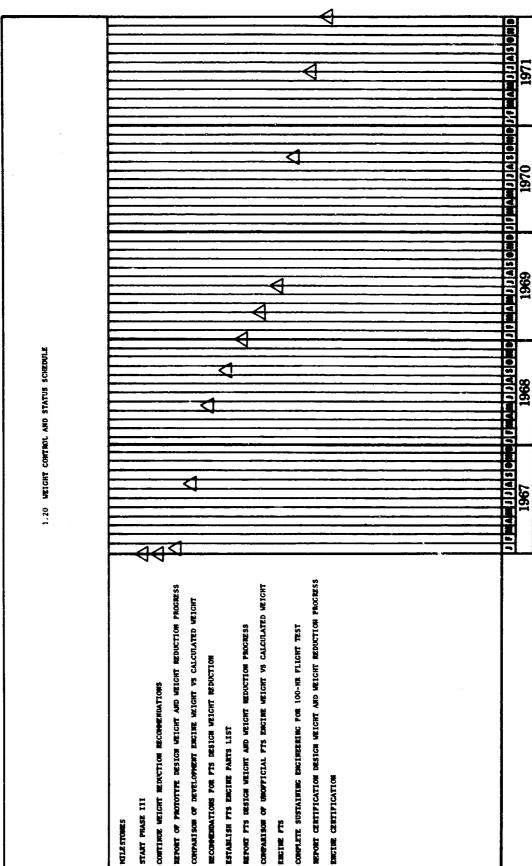
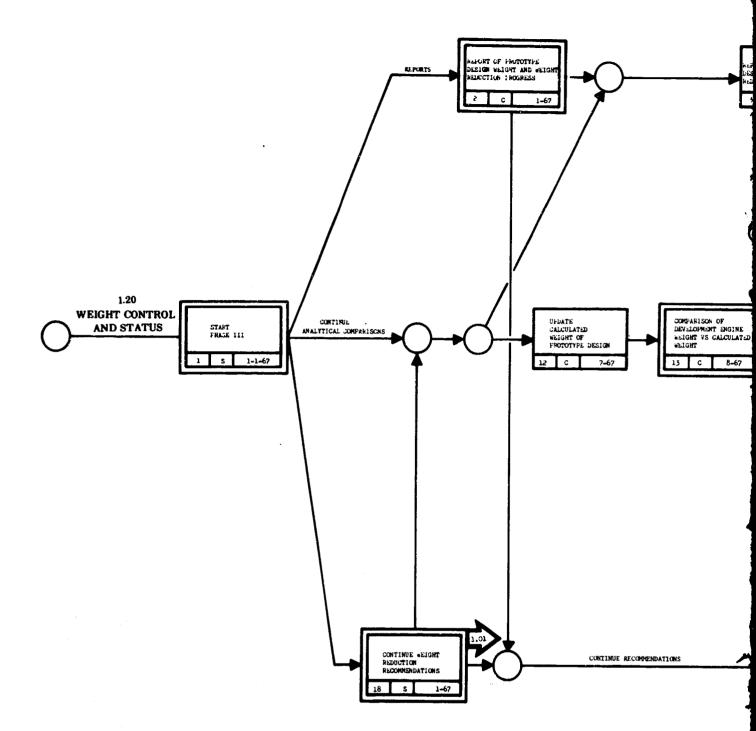


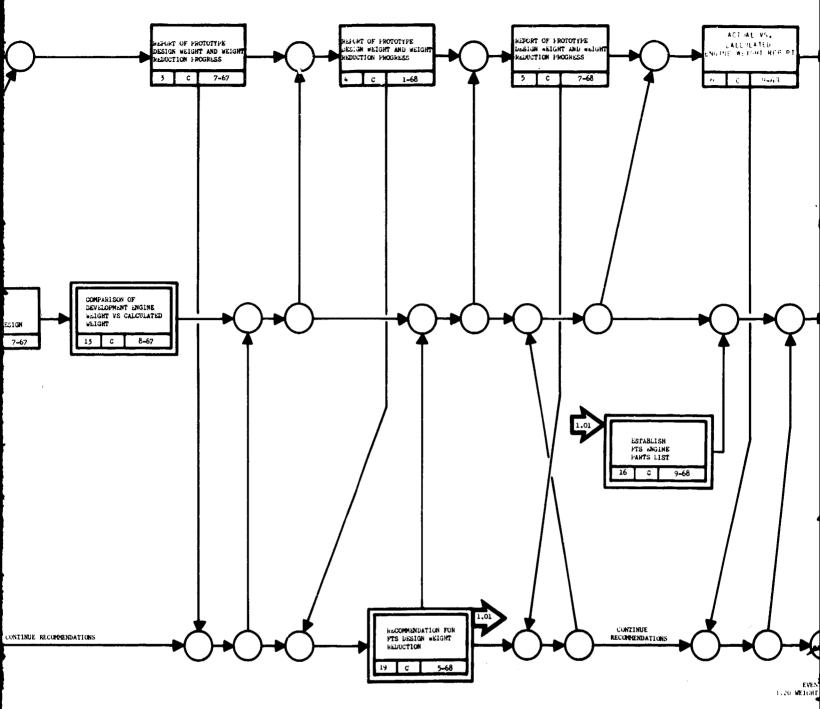
Figure 39. 1.20 Weight Control and Status



Event Numbe

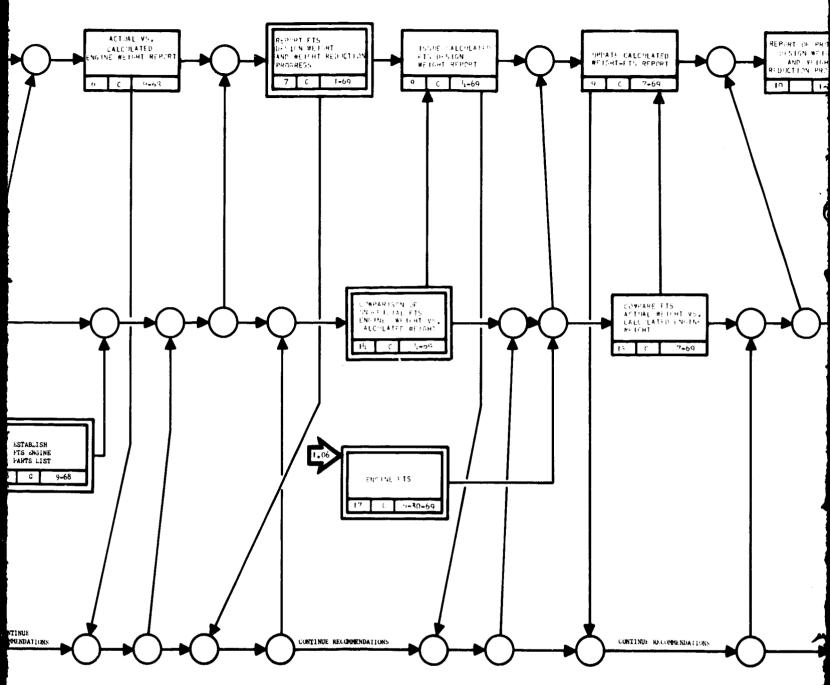
Figure 40. 1.20 Weight Control and Status

1.20 Weight Control and



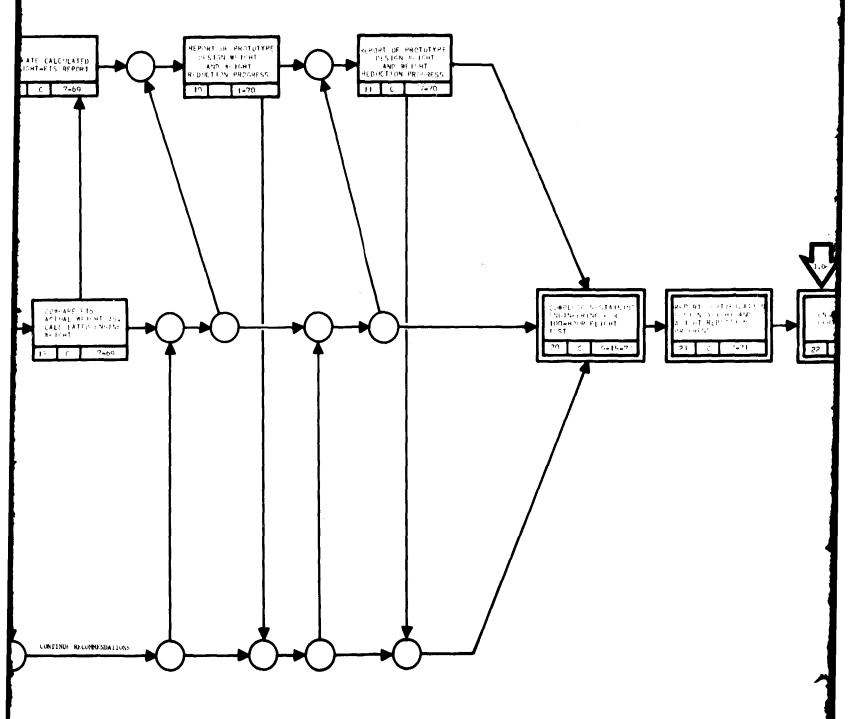
Event Number	Description and Uniteria	Event Number	Description and Criteria	Event Numbe
1	START PHASE III Start of Phase III. Phase III go-ahead received from FAA.	5	REPORT OF PROTOTYPE DESIGN MEIGHT AND WEIGHT REDUCTION PROGRESS Carrent prototype engine weight including sec- tional weight breakdown and weight reduction	10
2	REPORT OF PROTOTYPE DESIGN MEIGHT AND MEIGHT REPORTION PROGRESS Current prototype engine weight including sec- tional weight breakdown and weight reduction accommendation status. Issuance of report.	b	recommendation status. Insolance of report. ACTUAL VS CALCULATED ENGINE WEIGHT REPORT Comparison of the setual weight and calculated weight for the prototype engine. Issuance of report.	13
\$	REPORT OF PROTOTYPE DESIGN METCHT AND METCHT REPORTION PROCRESS Carrial prototype consine weight including sec- tional weight breakdown and weight reduction recommendation status. Issuance of report,	;	REPORT FIS DESIGN WEIGHT AND WEIGHT REDUCTION PROCRESS Provide FIS engine design weight status and weight reduction progress. Issuance of report.	1.7
4	REPORT OF PROTOTYPE DESIGN WEIGHT AND WEIGHT REDUCTION PROCRESS Corrent prototype caying weight including sec-	8	ISSUE CALUCLATED FTS DESIGN WEIGHT REPORT Updating of current FTS engine weight based on latest engine design. Issuance of report.	Li
	tional weight breakdown and weight reduction tecommondation status. Issuance of report.	ų	CPDATE CALCULATED WEIGHT OF FIS DESIGN Updating of prototype engine vergint based on FIS engine weight. I seemed of a post-	

Veight Control and Status Schedule



EVENT DICTIONARY
1,20 WEIGHT CONTROL AND STATES

d Criteria	Event Number	Description and Criteria	Event Number	Description and externa
N WEIGHT AND WEIGHT	fu	REPORT OF PROTOTYPE DESIGN WEIGHT AND WEIGHT REDUCTION PROGRESS	14	COMPARISON OF PROFETCIAL FIS ENGINE WEIGHT VS
wight including sec-		Corrent prototype engine witcht included ice-		to part on at the extent agent established
! weight reduction		trongl sclybe breakdown an weight reduction		we first the the another of HS couldness to page
Soduce of Topolt.		recommendation states. It came of report,		of acports
E WEIGHT REPORT Cight and valvalated	11	REPORT OF PROTOLYPE DESIGN WEIGHT AND WEIGHT REDUCTION PROGRESS	t i	COMPARE FIS ACT AT WEIGHT VS SACCIATED ENGINEWEIGHT
96.100. Is same of		Corrent prototype engine well by Including the		Comparison of F15 actual way it to the corner
		tional weight breakdown and weight reduction		positive ealerbated search, are cause of report,
		recommendation states, it tames of reports		
D METCHI, BEDGG1100			ţ	 For tool Fig. Physics (1984)
	1.7	CADMIE CMICLIMIED METOLIE OF ENGLODING DELICA		to define another finished distants of the couplets.
eight takes and weight		Epidatine of protetype one for we feet, at colons		Reserve of EDS on the capital artist of parties a
ce of report,		latest engine design. Its once of report.		
			:	FMGINE 4.15
WEIGHT REPORT	1 3	COMPARISON OF DEVELORMENT APTICALLY CALL LATED		Relationer englise influence light for its experimen-
the wir throaton		WE TOTAL		and cliffeling
ance of report,		Compary on of the actual weight and calculated		
		wright for the prototype design engine. Assume	1 :	CORPLANT SELECT RED CITOR RECORDINARION
FIS DESIGN		of report.		the street asks of residention to concentration and dis-
s beautiful transactions				Late of the corespondations, I have of
of report,				wite to tell the Report,
			19	RECURREDICTION FOR \$15 DESIGN AS TORE RED 5 1106
				here the all almost reduction than about the day
				FIS design and report of progress, designer or



Dest	i pi	1095	4nd	Criteria.
	-			

ACCORNOL NOTICEMETED FROM METCHEVS STATED ADJUST OF A CONTROL OF CONTROL OF A CONTR

ARE BUY AND AD WELDING AND CARD CRAFF FROM 150.

ART 11. A. A. A. Fridin V. CARCIARIO PAGINO 12.

Microsoft from College. Color carries and for more Color and for the carries of acquire Color and the Color and Color

CLOP WIND REPORTED RECOMPOSED STATES

THE STATE OF THE CONTROL CONTROL CONTROL

THE RECOMPOSED STATES OF THE RESERVE OF THE CONTROL CONTROL

THE RESERVE OF THE STATES OF THE RESERVE OF THE CONTROL C

Event Norther

25

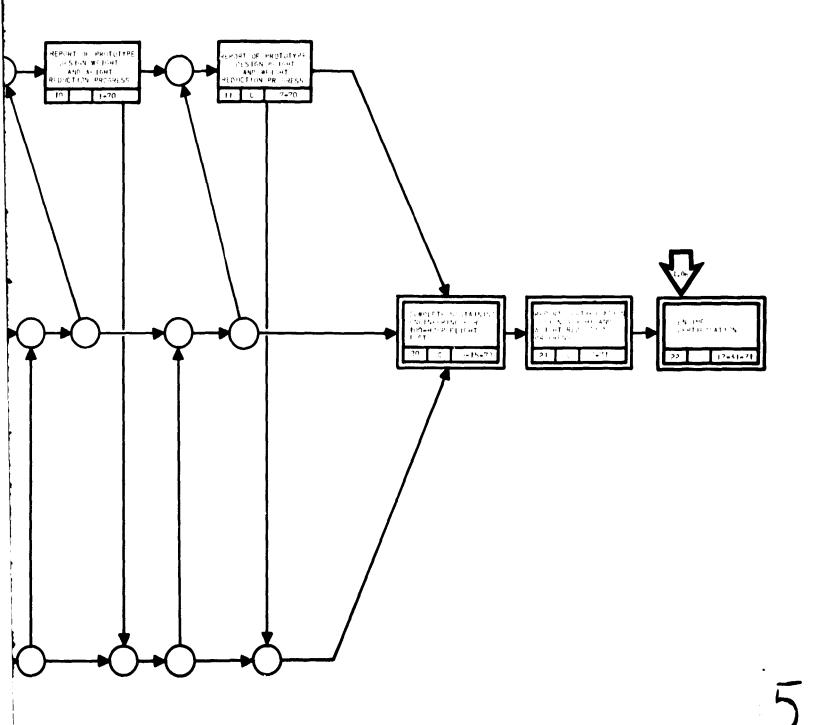
21

Disciption and Criticia

COMPLETE SUSTAINING ENGINEERING FOR TOOLIGER PLICED IN THE STAINING ENGINEERING FOR TOOLIGER OF THE STAIN TOOLIGE OF THE STAINING TOOLIGER OF THE STAINING TOOLIGER OF THE STAINING TOOLIGER OF THE STAINING TOOLIGER OF T

REPORT FIRST PRACTOR DESIGN WEIGHT AND WEIGHT REPORTED FOR THE PROPERTY OF T

PSCCN COMIL 0.0105 (Cl. 10.00) C. p. C. retsouk (Loweton de Cription 2007 Clitical)



Exemples of

the appear of the streets

COMPUTATION OF A PARTIES OF A COMPANY OF A STATE OF A S

REPORT CONTROL OF OR OTHER WILDS AND ADJACO PROPERTY OF A STATE OF THE AND ADJACO PROPERTY OF A STATE OF A STA

Paging Files (1942) 66 Ballon Communication of the consultation and Consultation

PWA FP 66-100 Volume V

SECTION II MANAGEMENT CONTROLS AND PRODUCT ASSURANCE

2.01 COORDINATION

The integration of the JTF17 engine and systems with the airframe is accomplished through the interaction of the Design, Project, Installation, and Field Engineering groups; by coordination with the airframe contractor; and by coordination with the airlines.

Installation Engineering channels technical information in both directions from Program Management to the airframe manufacturer and engine operators. This is done through the Field Engineers and Flight Operations Engineers who make direct contacts with the airframe manufacturer and engine operators on a continuing basis.

The Installation Engineering groups coordinate the installation design requirements for the JTF17 engine to ensure complete compatibility of the engine-airframe combination relating to installation, performance, operation, reliability, safety, maintainability and economics. In addition, these groups integrate airframe requirements into the normal engineering development and the sustaining engineering programs, which continue after the enginess are certificated and enter operational service. An Installation Handbook and Installation Drawings are prepared to define for the airframe manufacturer and the airlines the engine features which must be considered in the design of the aircraft. Thus, the Installation Engineering groups are the clearing house for the engine/airframe technical coordination outlined in the Airframe/Engine Compatibility Agreement described in detail in Volume III, Report D. Test planning and integration is presented in Test, Volume IV, Report E.

These groups also fabricate engine mockups and keep them up-to-date. These mockups are used as aids during the initial design as well as to evaluate the installation compatibility of subsequent changes to the external portion of the engine. These changes are coordinated with the airframe manufacturer before preparing Engineering changes. As these changes are released, the airframe manufacturer is provided with incorporation schedules and revised Installation Drawings which show the physical effects of these changes.

Concurrent with the coordination of engine installation requirements, the Engine Performance Group provides basic engine performance data and performance correction data which permits use of specification data at off-standard conditions with varying ambient temperatures, engine air-bleed flows, accessory power extraction, inlet duct losses, etc. This group also assists the airframe manufacturer by reviewing and commenting on ground and flight test data. Engine Operating Instructions along with powerplant simulator information are also provided by this group as changes are made and prior to installed engine operation.

PWA FP 66-100 Volume V

Installation Engineering groups also coordinate with the airframe manufacturer and the accessory manufacturers the requirements and specifications pertaining to special airframe required, engine-mounted accessories.

The major milestones are shown below:

Complete Engine FTS	30 June 1969
Complete Engine Certification	31 December 1971
Complete 100-Hour Flight Test Program	15 September 1970
Aircraft Certification	15 May 1974

2.02 MAINTAINABILITY AND HUMAN ENGINEERING

MAINTAINABILITY

The Maintainability Program provides the effort to ensure a maintainable powerplant throughout all phases of the JTF17 engine program from design inception through operational service and is described in detail in Volume IV, Report F, Section 1. This program encompasses the following effort:

- 1. Establishment of maintainability objectives and requirements
- 2. Prediction, assurance and verification of maintainability objectives and goals
- 3. Integration of maintainability group activities under the direction of a maintainability engineer.

The major objectives of the Maintainability Program are to reduce engine maintenance costs and minimize engine-chargeable down time. These objectives are to be achieved by integration of features into the engine design to reduce the frequency and the time required for engine maintenance; thus assuring the maximum availability of the supersonic transport aircraft during prime operating periods.

HUMAN ENGINEERING

Human Engineering objectives in the Supersonic Transport Program are to amplify and sustain personnel effectiveness during the manufacture, operation and maintenance of the JTF17 engine. Human Engineering is primarily associated with maintainability and is an identifiable function of each maintainability group. The Human Engineering Program is a continuation and expansion of the effort established in Phase II-C and is described in detail in Volume IV, Report D.

The objective of the Human Engineering Plan is to integrate the principles of human physical and psychological characteristics into the engine and ground equipment design. This integration ensures that maximum man-equipment efficiency and safety is designed into all engine components and maintenance equipment.

The Human Engineering effort is guided by MIL-STD-803A and emphasizes personnel convenience and safety, man-equipment accuracy and the combined man-equipment capability. The basic operations for accomplishing the goals of the Human Engineering Program are:

- 1. Personnel orientation in Human Engineering philosophy
- 2. Engine and equipment design review
- 3. Continuing review of engine and component mockups
- 4. Review of all engine changes
- 5. Survey of existing engines for improved Human Engineering features
- 6. Investigation of internal and field problem reports.

In-flight factors, such as internal component containment and cabin air purity, are included in the Safety Program described in Volume IV, Report C.

PWA FP 66-100 Volume V

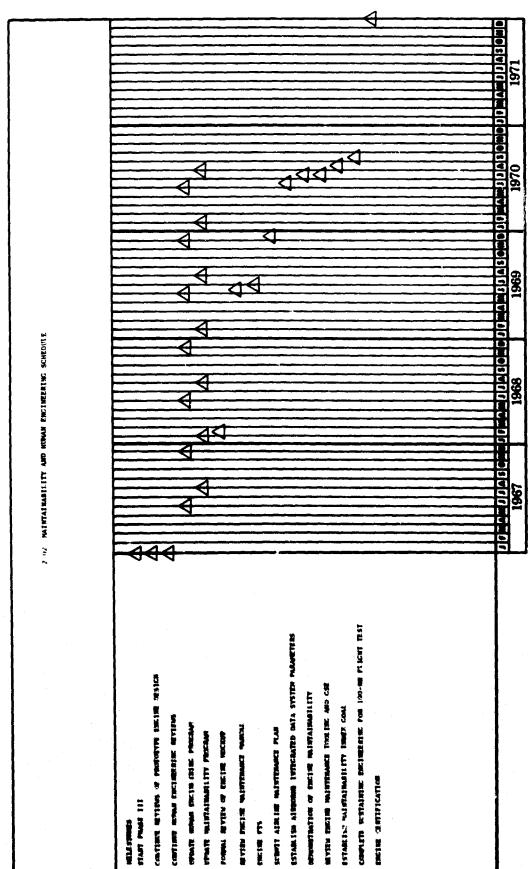
The major milestones, network chart and event dictionary for the maintainability and Human Engineering Program are shown in figures 1 and 2 respectively.

Test planning and integration of maintainability and Human Engineering is presented in Test, Volume IV, Report E.

Pratt & Whitney Aircraft
PWA FP 66-100
Volume V

FD 17881

H



(

Figure 1. 2.02 Maintainability and Human Engineering

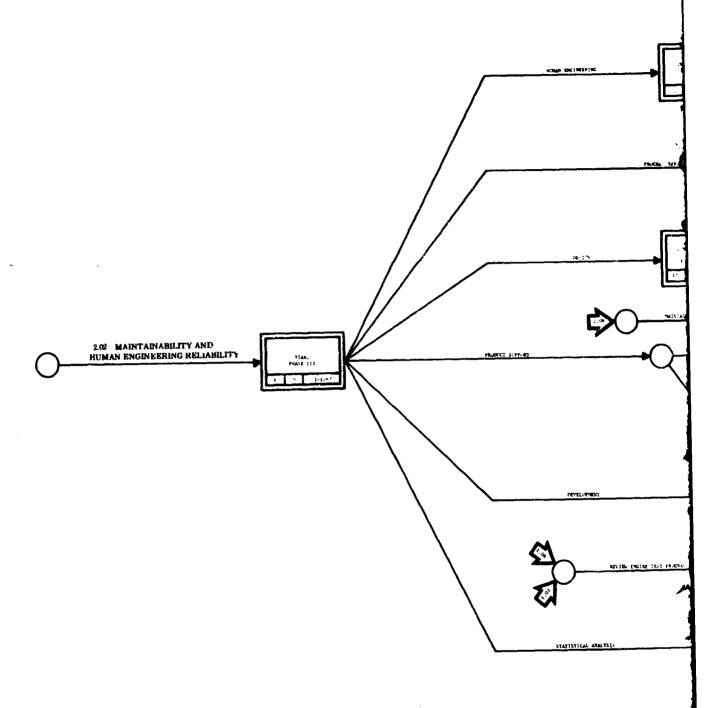
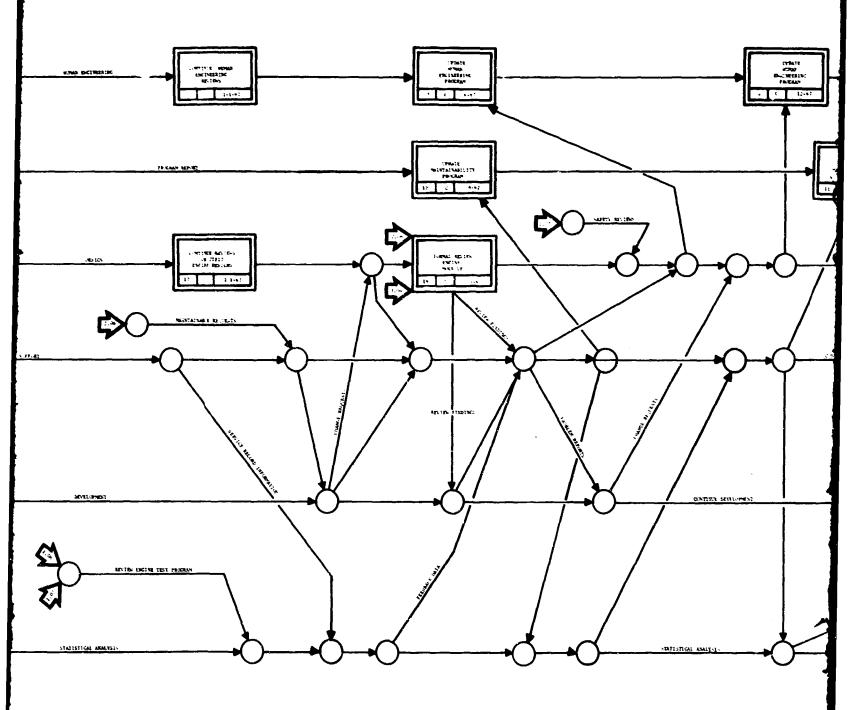


Figure 2. 2.02 Maintainability and Human Engineering



Event Number	Description and enteria	Lvent	No.
i	STARS PHASE III		
	Statt of Phase III. Phase III gorahead typograd		
	:1 = 1M		
;	CONTINUE HAWAR ENGINEERING REVIEW		
	Deline all areas affecting tumon regimering		
	diving levelopment feating compare list of		
	action taken to remove basards and suprove		
	human mightorering tratutes		
)	UPDATE HUMAN ENGINEERING PROJUME		
	Opdate engine human angineering payers to		
	retiest within taken to reache hazards during		
	development tentang. Include results of safety		
	reviews and design mousip textes.		
,	OFFIATE PENAN ENGINEERING PROGRAM		
	Codate engine commit engineering program to		
	retired better taken to reactive hazards during		
	development testing in into require of safety		
	textere and design mackup seview.		

Descript: , and Oritetia

PROGET HAMAN ENCONERING Enchance

Undate engine haman engineering program to
selfont action favor to revolve farands during
description texting. The node results of water
favores and design howard texting.

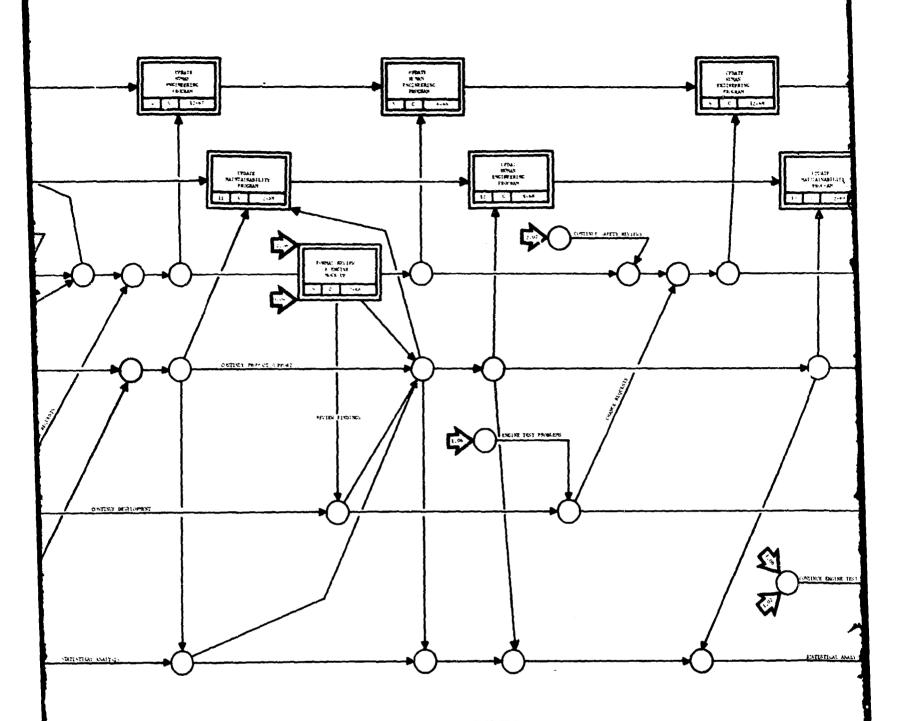
UPDATE HUMAN PROSERTING PROGRAM

Applete ingree Values engineering program to
fulled action time in resolute tratards lagging
development features. The object tratards lagging
development features. The object tratards and development in the object
reviews and development of tratars.

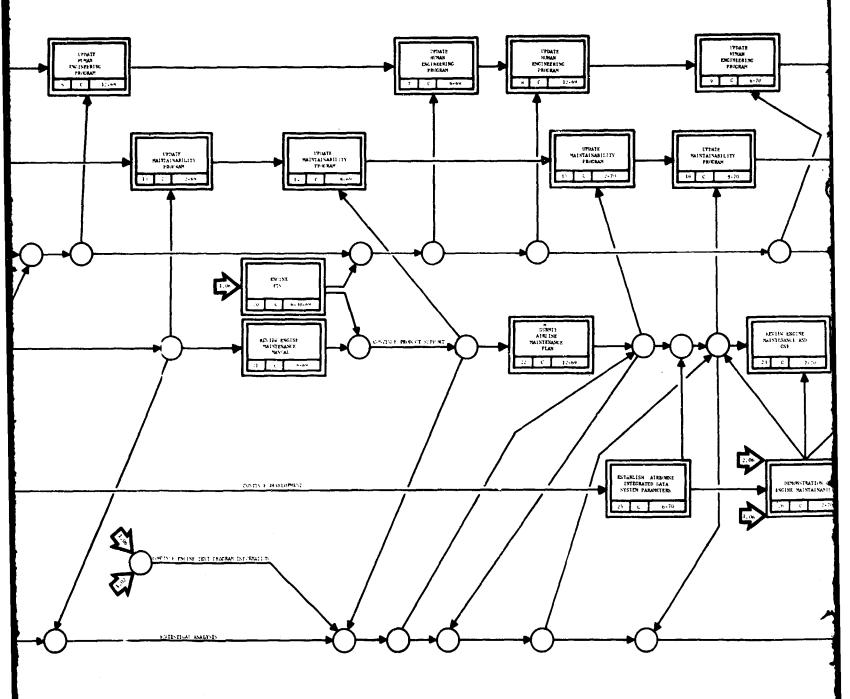
reviews and design models for the UPDAT in that Engineering Program to collect each or boson registering program to title for the containing to the local behands during design participation. To collect results not safety testings and design models results of safety testings.

CHAID NOWAN ENGINEERIN PRINCEAP
CHAIR cognot have instructed a program to reflect action case of teacher hattide budge development better that action case of teacher hattide budge development better in the construction of design will be trained and design will specific actions.

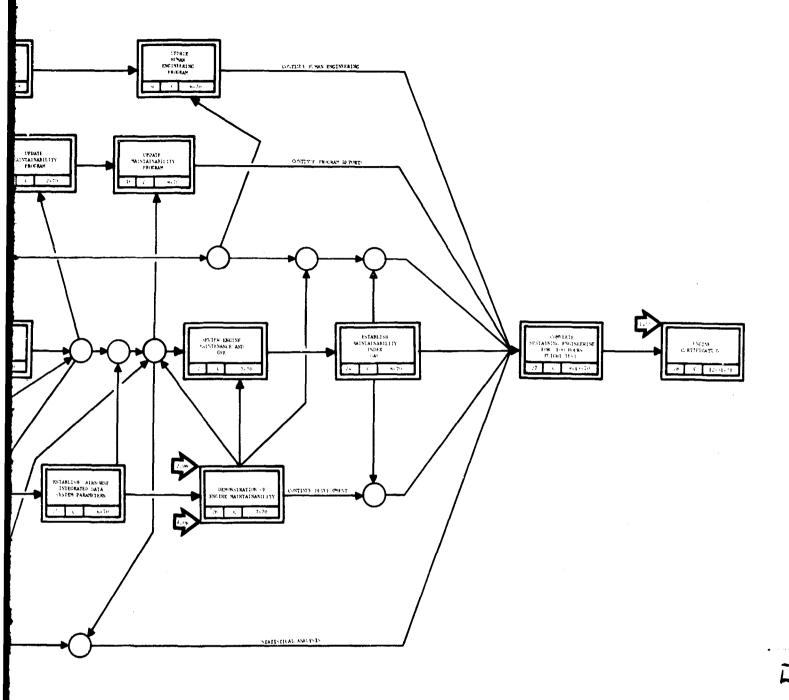
2.02 Mainteinability and Human Engineering



			INT DICTIONARY STLLEY AND HUMAN ENGINEERIS	k;		
Precription and Criteria	Event Simber	Description and Seffers	Event Number	Description and Criteria	Event Sumber	
PRIATE HUMAN ENGINEERING PROGRAM	4	EPDATE INMAN ENGINEERING PRINGRAM	4.9	UPDATE MAINTAINABILETY PROGRAM	.*	FORMA:
Postate eretty bases environment of erest		Update engine forman cognicering program to		A semi-annual caputt covering pangress in the		F - 5(19)
retient a tion times to reduce a source to		coffeet without taken to reactive barrieds during		matrice anability program is provided. Issuance		Language
development first care. Too hole texacts of same		development testing. Include specific of waters		+1 reports		
to come and descap because he can		reviews and design seckup reviews			19	FORMA:
			1.	UPDATE MAINTAINABILLIY PROGRAM		Ca Silver
CITATE OF MEN ENGINEERING PRODUCT	10	UPDATE MEINIAINABILITY PRINTAM		A semi-amount report covering progress in the		6.36564
Egitaban - gotin human kings medicing \$25, 22.45. t		A new, - which report coverage progress on the		mainternated transferance in provided. Tempance		
Property and the taken to be written for early large		mentionability progress as provided. Issues of		et 11891.	20	ENGINE
much provide testings. A colorado interior water,		of reports				Arts ce
treamen and design School to the			4.5	UPDATE MAINTAINABILITY PROSRAM		red co
	+1	UPDATE BAINIAINANIU D. PRIKABAN		A sense tennet report courting progress in the		
CEDALE REMAY ESCUE FROM PURISHED		A semi-annual report cosessed broutens in the		maintain shiftly program is provided. Insurance		****
Epidate organic limson a square-raise principal to		meantainabalate program is provided. Issuance		of report.		Ke , see
reflect action taken to rescine hazarts history		1 report.				1 -4 - 14
texal general feedings. Brolling a pitch 1 pagets			ş m	CEDATE MAINTAINANTILLY PROBLEM		Tealsa
tracemported descript the hospitations.	12	CPTM TE MAINTAINABILLITY PROGRAM		A semi-amount report overtion progress, to the		
		A nemicality territy of our is a program and the		maintainability program is provided. Intuition	••	S(1991)
LITTINITY, HUMAN SMITTNEER THE PROBLEM		maintainability program is provided. Insusace		21 (ep ()		10.114
Column ingene towar angertari is program to		el repett.	17	CONTINUE REVIEWS OF JITE? ENGINE BESTON .		114
retires action taxen to appeal or foreidal durang			17	Continue services of 11115 region desired to		Rt vit e
desails peant traditing, include tradition of artest				construct twice of their signification to		Credie
annumber and demograms may be com-				testures. Maintagraphically from the are		1 7 1
				Convolent, requirementally from the are		



1.trtia	Event Simber	Description and Children	Event Number	Description and Criteria
es e	, 8	FORMAL REVIEW OF FOURTH SANCKUP	24	ESTABLISH MAINTAINABILITY GOAT INDEX
Line when he was the control of the		togital of the covered the engine market couplets a most eventure		Estimate maintenance manhouse per organic blight from let condition continuous commanical sets per Compute the estimate.
	14	TORMAL MENTEW OF ENGINE MOUNTY		
M.		tendest a retroit review of the paying maker.	2.9	ESTABLISH ATRIORNE INTEGRATED DATA SYSTEM FARAMYTE
primer of the		Captate India testion.		extending parameters for althouse integrated data system. Propore client of pitterfits.
	2.0	Chapter FDs		
f		Reference engine personal at the for description	26	DEMONSTRATION OF ENGINE BAINTAINASULTY
(m		to for the parameters of the second s		Demonstrate the inspection and magniferance features of the regim to the FAA, virtues, and make two
a colo de la descripción	. (RELIEN ENGINE MAINTENAGER MANUAL		personal, temperate the assessingtion.
		Review engage Departemance manual, to versus		
		are resent por all deserted maintenageriats	24	COMPLETE SUSTAINING ENGINEERING FOR LOOPINGUE
ku .		bertigion. Complete trajen of seguith.		FIGHT DEST
Constant of the				End Phase 111. completion of Abdours of Flinds
collid Insurance	22	SCHMIT AIRLINE MAINTENANCE PLAN Frepare in angles real Commune plan lea ess		text mg.
		by the expression was submit plan-	. #	ENGINE CERTIFICATION
THE DESIGN				Reference engane metwork 1.06 for John tipf for
are assess to	,	REVIEW OF ENGINE MAINTAINABILITY TOOLING AND USE		tel criteriote
or Parity		conduct a respect charge maintainabases toops		
At a second		on, and are and support equipment. To queta the		
٠.		TRULE W		



FD 17831 VII

PWA FP 66-100 Volume V

2.03 RELIABILITY

Reliability encompasses the management control and engineering functions that ensure compliance with the reliability goals of the JTF17 engine. It is accepted that every useful reliability technique must be employed to meet these requirements. Emphasis has been placed on program visibility, computerized information retrieval systems and the statistical reliability assessment.

To improve management control a reliability organization has been created under the Product Assurance Manager. The Chief of Reliability and Safety reports to the Product Assurance Manager and is responsible for all reliability analysis, assessment and reporting. The Design Reliability Group and the Development Reliability Group receive their technical direction from the Reliability Engineer. All reliability activities are described in detail in the Reliability Program Plan, Volume IV, Report F, Section II and are listed below:

- A. Design Reliability Activities
 - 1. Design Review
 - 2. Reliability Trade Studies
 - 3. Reliability Block Diagrams
 - 4. Failure Mode and Effect Analysis
 - 5. Reliability Apportionment
 - 6. Reliability Mathematical Models
 - 7. Review Historical Data
- B. Development Reliability Activities
 - 1. Failure Data Analysis
 - 2. Critical Parts History
 - 3. Reliability Assessment
 - 4. Reliability Problem Files
 - 5. Statistical Engineering
- C. Joint Reliability Activities
 - 1. Reliability Training
 - 2. Coordination Airframe-Engine Reliability Interface
 - 3. Vendor Reliability Control
 - 4. Reliability Reporting

The major milestones, network chart and event dictionary for the reliability program are shown in figures 3 and 4, respectively.

Test planning and integration of reliability is presented in Test, Volume IV, Report E.

PWA FP 66-100 Volume V

> FD 17882 VH

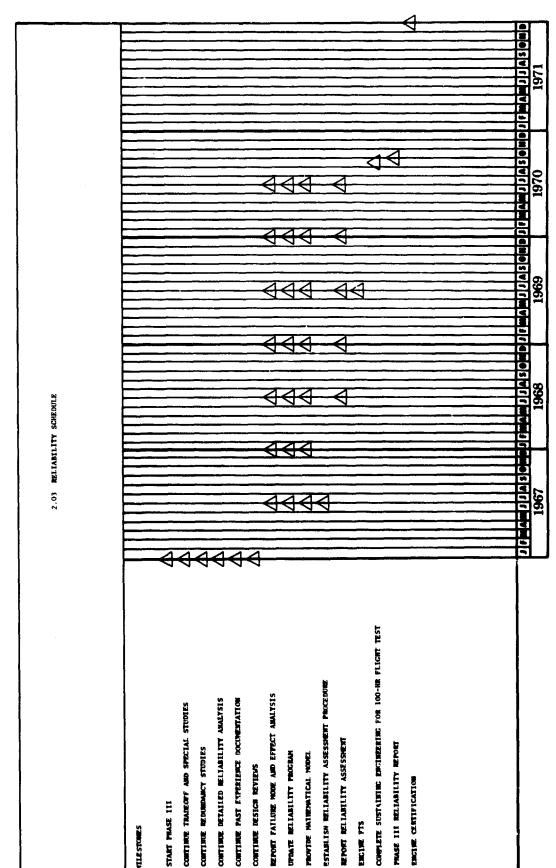
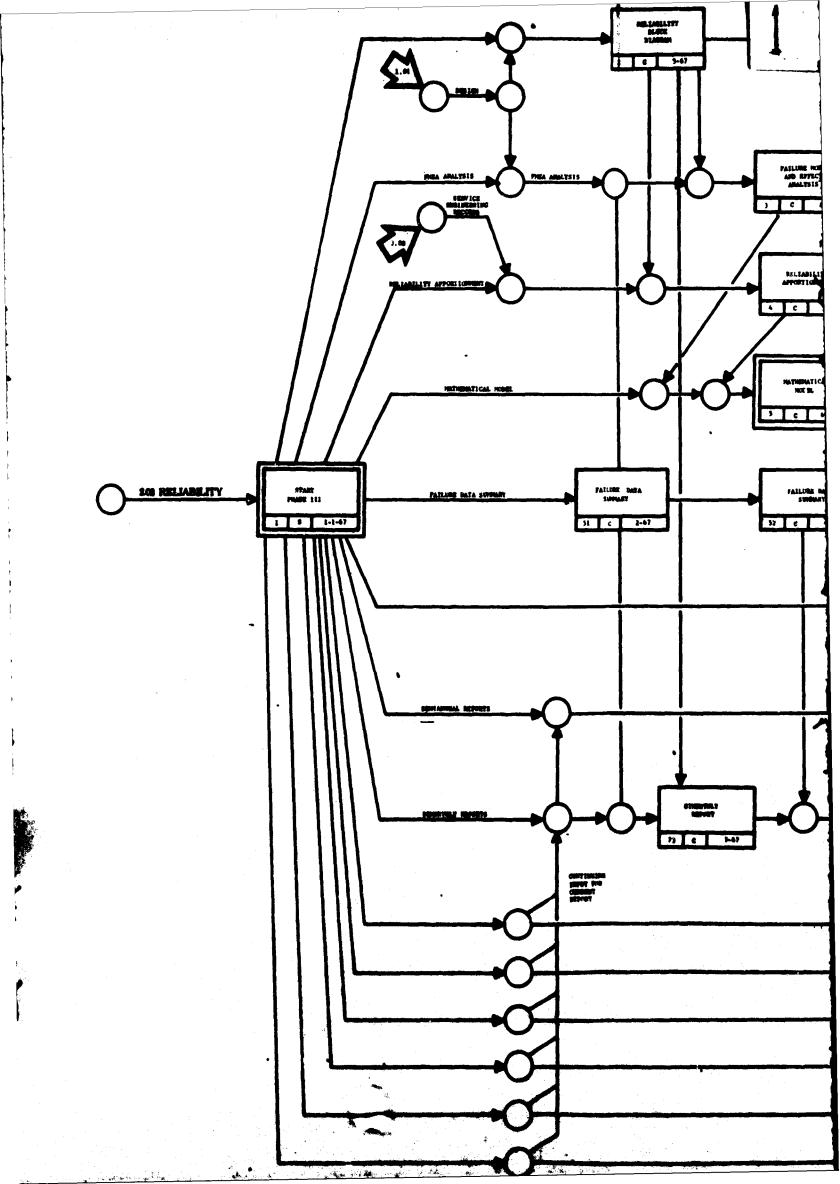
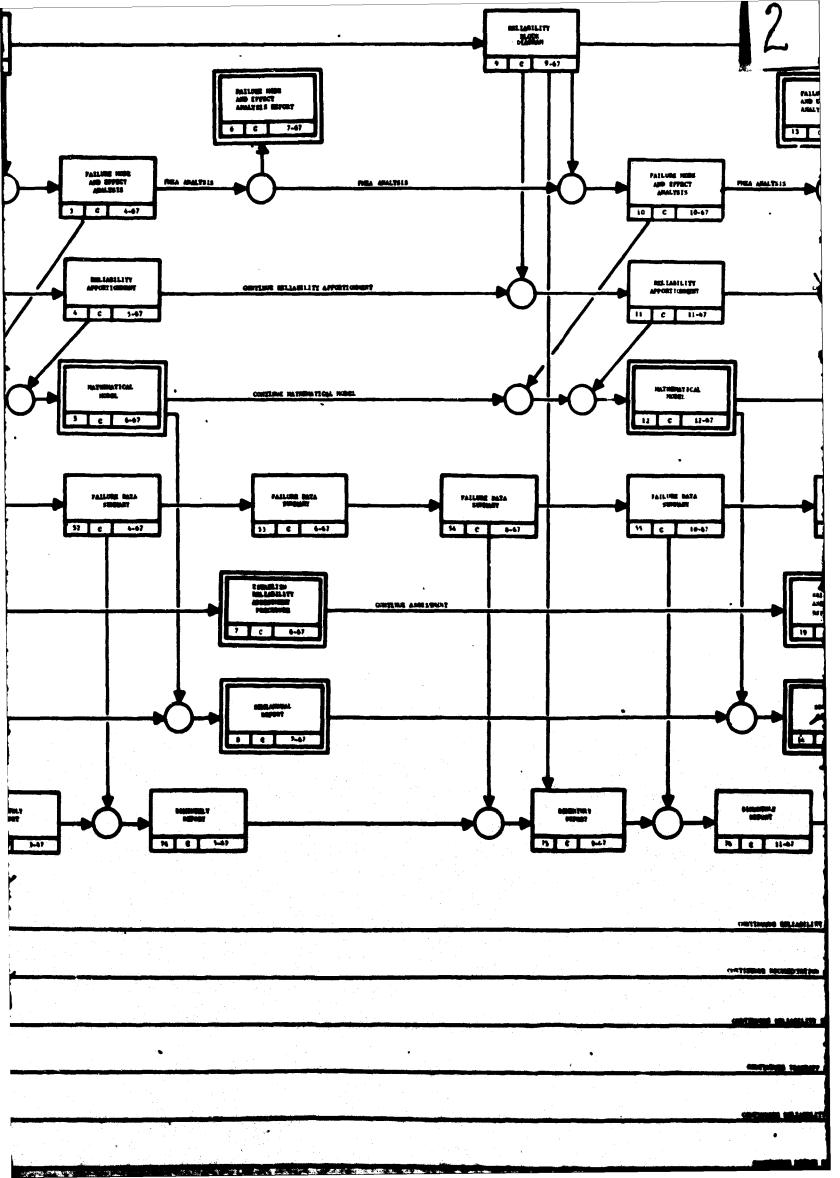
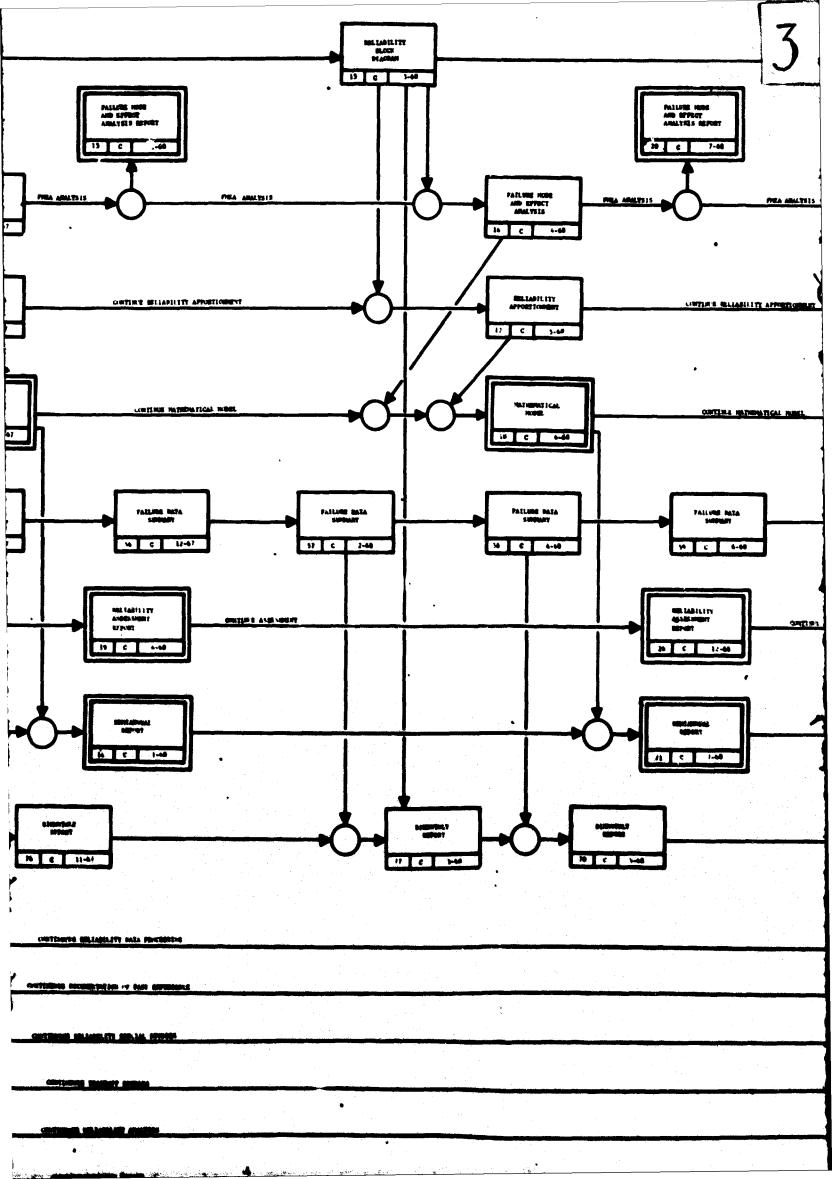
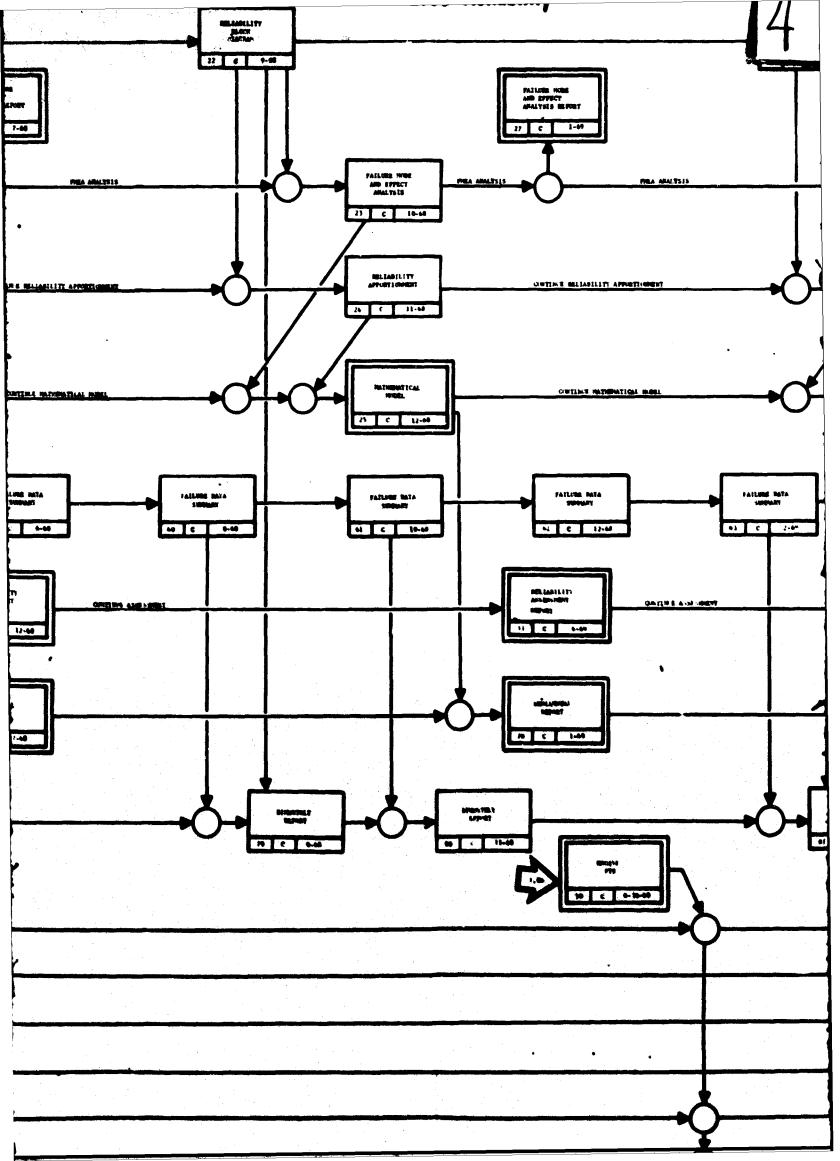


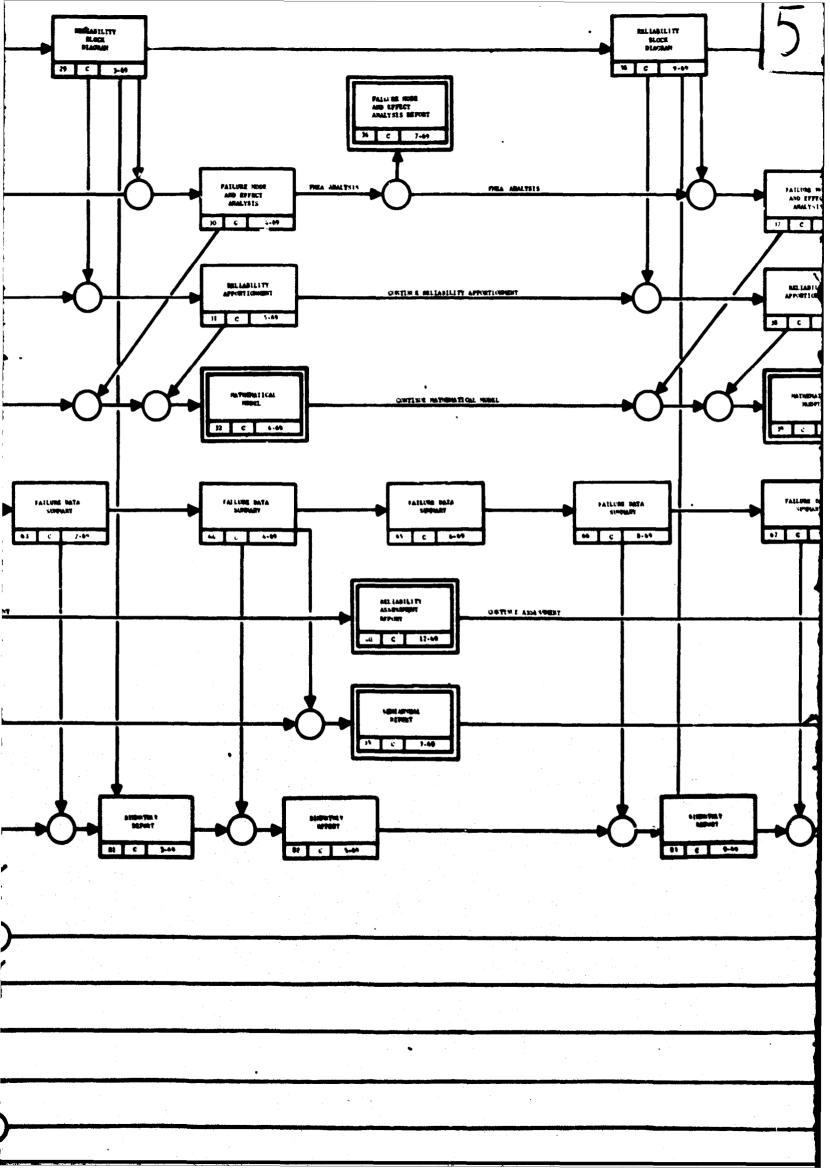
Figure 3. 2.03 Reliability

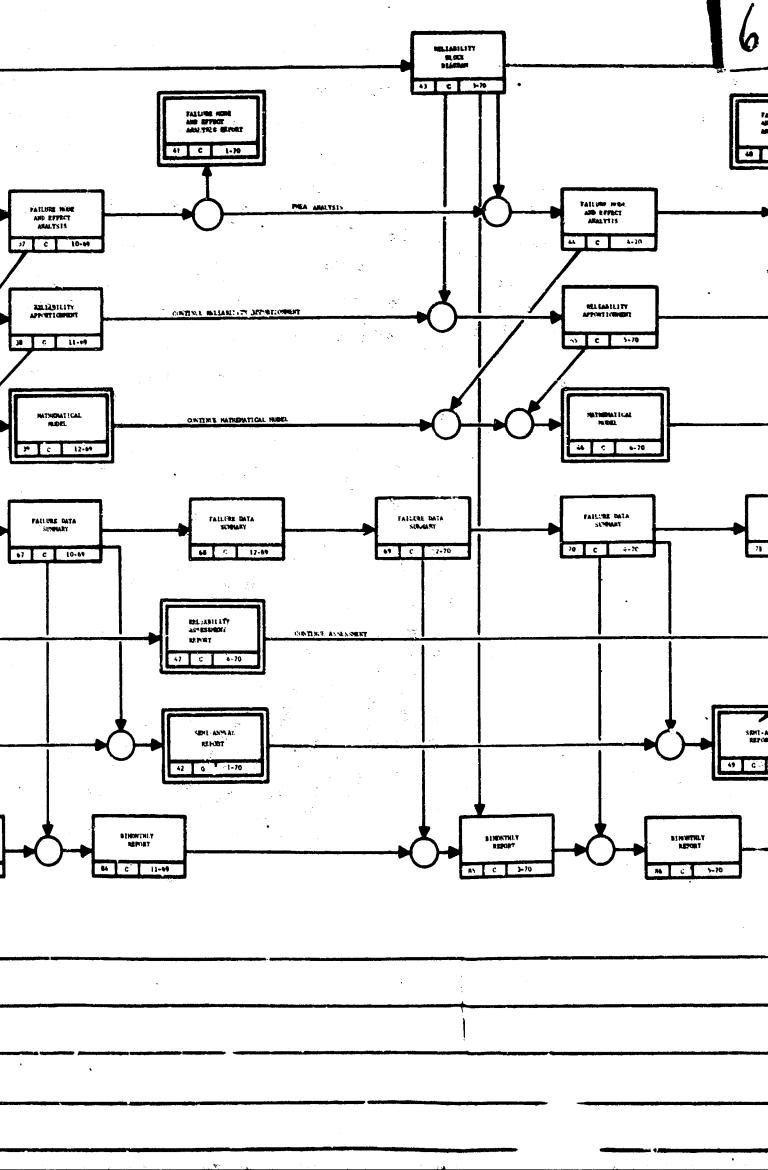


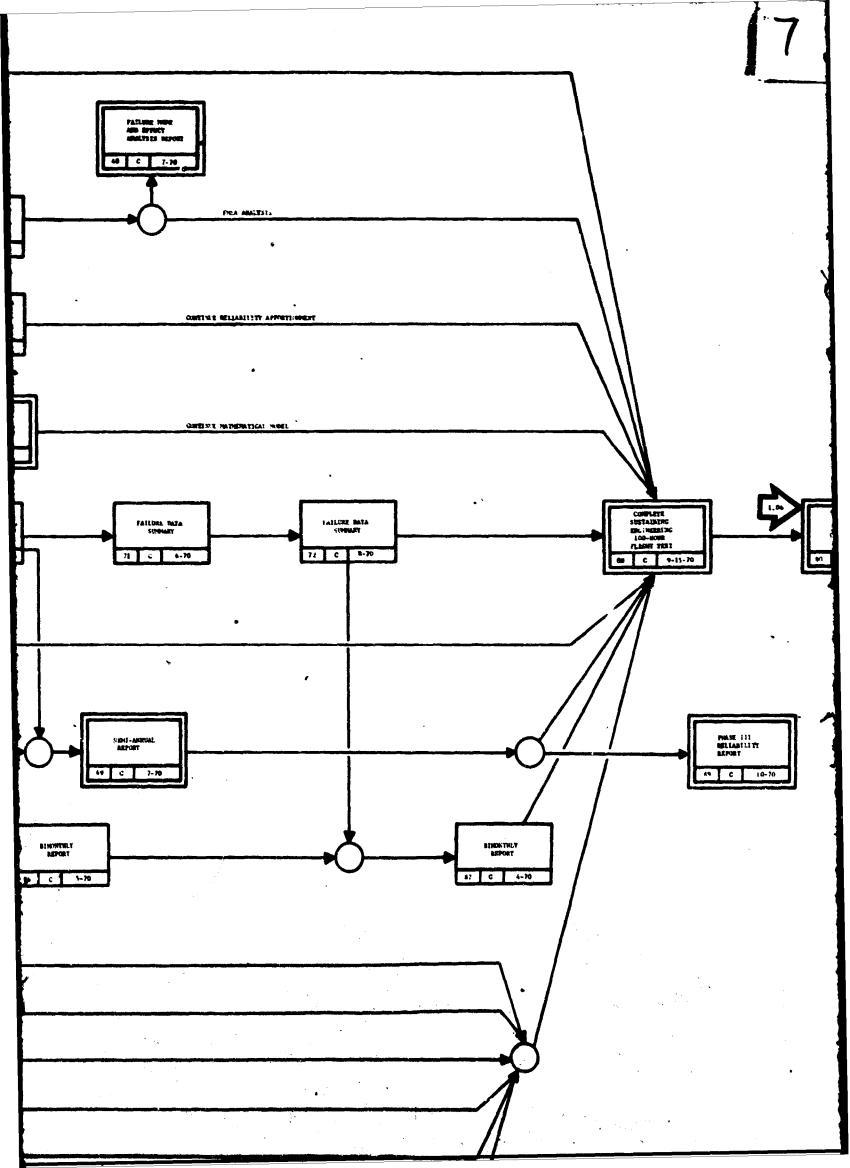


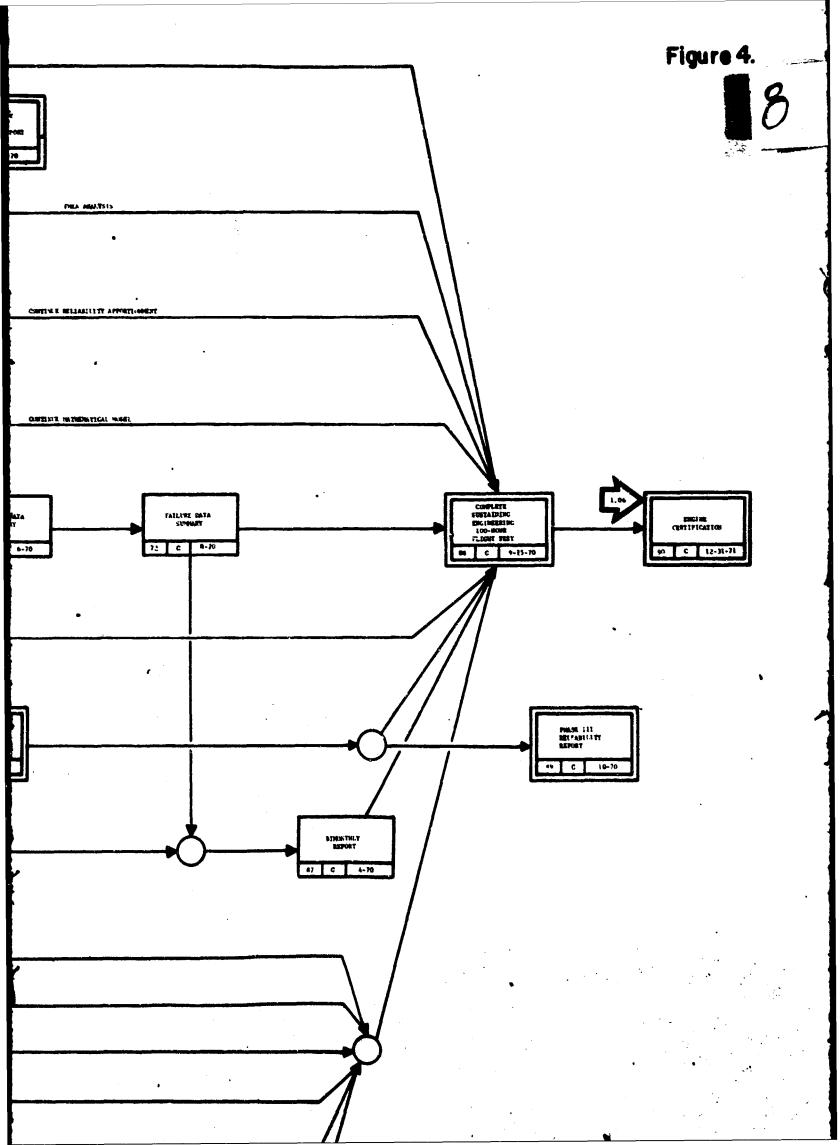


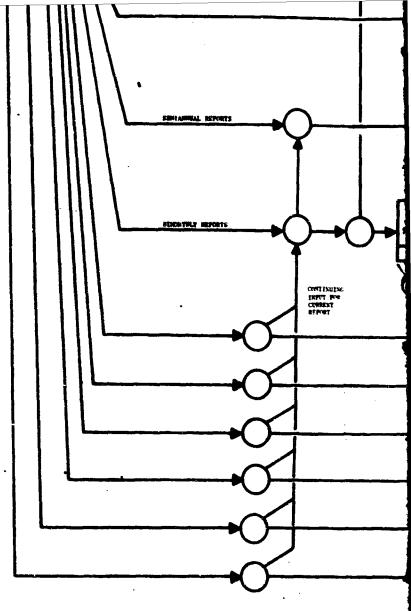












Event Number

Beautiption and Criteria

10

Description and Criteria

START MASK 112 Start of Phase III. These III gurdhead received from FAA.

BELLASILLTY SLOCK DIAGRAM Blageme showing logical relation of parts in a component, components in a subsystem, and subsystems in the JTST. Updated to reflect letest design. Issue block diagrams.

PAILMER MODE AND EFFECT ANALYSIS An analysis of all potential failure modes on all prival components and parts shows on the reliability block diagrams, event 2, comsidering a single failure at a time. Includes; failure effects on subsystem, engine and afteraft, method of detection, siev action required, design philosophy to preclude saliure, hanard cleasification and design criteris to reduce hazard. Failure mode and effect analysis is updated each time block diagrams are updated and at least every air bonths. Current incluse mode and effect analysis is dependent on issuance of current block diagrams (event 2). Sucquestul accumplishment of this addition is determined by completion of analysis.

RELIABILITY APPURITIONNESS:
Partitioning or apportioning the overall JTF17
reliability goals manns the JTF17 subsystems and parts, as shown on the reliability block diagram, event 2. Requires updating an program progresses it more effort is required on a subsystem.
Apportionment is subject to completion of reliability block diagram (event 2). Accompitability block diagram (event 2). Accompitability is denied by insume of the apportioned subsystem and engine reliability goals (failures/1000 hours).

NATHEMATICAL HORSE retrumentation remain A computer program which apportions the reliability requirement of a system to the suspendents and subsystems. The apportions ment is based on the probability of compose failure and conditional failure of mission due to component tailure.

PATHEMATICAL HUBBL (Continued)

1. Failure mode and effect analysis must be completed previously (event 3).

2. Relfability apportionment must be completed previously (event 4).

3. Hathematical model is complete when criticality lieting is published.

PAILURE NOTE AND EFFECT AMALYSIS REPORT Insurance of failure mode and effect analysis report. Leauence of report.

ESTABLISH EXLIABILITY ASSESSMENT PROCESSES Satablish ground rules and prucedures acceptable to management and Federal Aviation Authority for the evaluation of reliability parameters, such as mean time between faitures (HTMP), premature engine remuyal (PER), etc. assessment processes and processe removal (PSR), etc. Publish reliability assessment procedure.

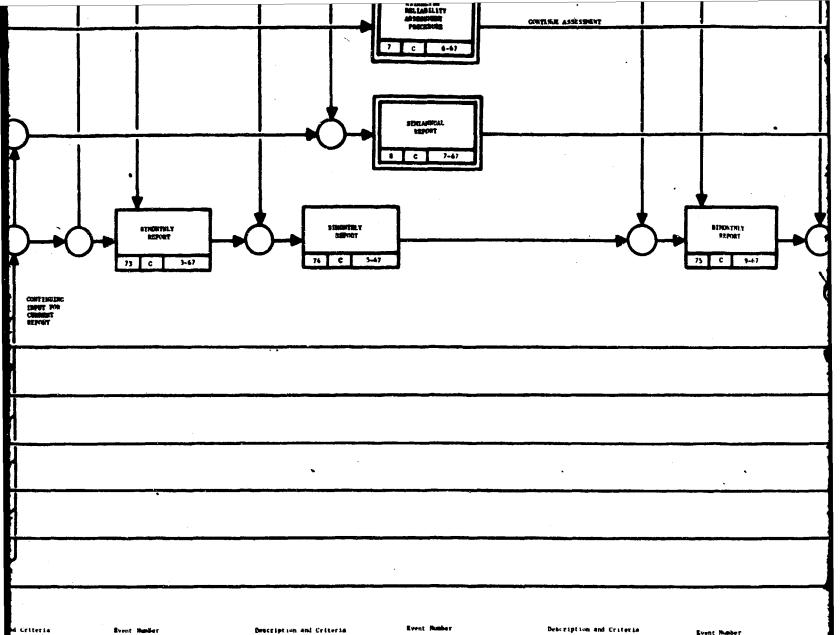
SEREAMBAL RELIABILITY REPORT section of the progress report to date (through June 1967).

RELIABILITY BIJCE DEAGRAM Diagrams showing logical relation of parts in a component, components in a subsystem, and subsystems in the JTF1/. Updated to reflect latest design.

reliest latest design.

PALLINE MODE AND EPPECT ANALYSIS
An analysis of all petential failure modes of
all JTF1 components afflipate shown on the
reliability block diagrams, event 0, compidering
a single failure at \$\frac{1}{2}\$ time. Includes, failure
refects on subsystem, engine and aircraft, method
of detection, eree action required, design philosophy to preclude failure, hazard classification
and design reteris to reduce heared. Enforce
mode and effect analysis is updated each time
block diagrams are updated and at least every six
midpendent on issuance of current block diagrams
(ovent 0). Successful accomplishment of particular
edition is determined by completion of maiys is.

Pratt & Whitney Aircraft



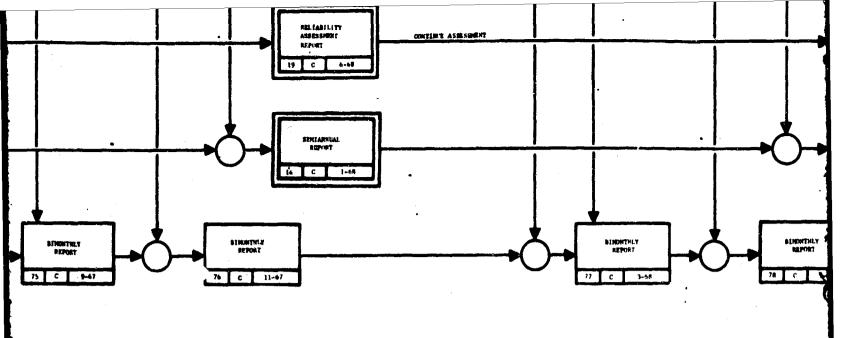
nued) tc analysis must y (event 3). ent must be event 4). complete when published. MALYSIS REPORT and effect 4nelysis	ıı	RELIABILITY APPORTINGEMY Partitioning or apportioning the overall JTF17 reliability goals among the JTF17 subsystems and parts, as shown on the reliability block diagram, event 9. Requires updating as program progresses if more effort is required on a subsystem. Apportionment is subject to completion of reliability block diagram (event 9). Accom- plishment is denoted by insuance of the apportioned subsystem and engine reliability goals (Jailures/1000 hours).	16	FAILURE MODE AND EMPECT ANALYSIS An analysis of all prevential failure modes of all 1971/ components and parts shown on the reliability block diagrams, event 15, considering a single failure at a time. Includes; failure effects on subsystem, engine and airciaft, method of detection, crew action required, design philosophy to preclude failure, hazard classification and design inferia to reduce hazard. Failure mode and effect analysis is updated each time block diagrams are updated and at least every six months.	10
Essein PROCEDURE Id prucedures and Federal se eveluation of	12	MATHEMATICAL MUDEL Computer program which apportunes the reli- shifty requirement of a system to the components and subsystems. The apportionment is based on		Current failure mode and offset analysis is dependent on issuance of current block diagrams, event 15. Successful accomplish- ment of particular edition is determined by completion of enalysis.	•
uch as mean time premature engine ement procedure.		the probability of component failure and con- ditional failure of mission due to component failure. 1. Failure mode and direct analysis must be	17	RELIABILITY APPORTIONMENT Partitioning or apportioning the overall JTF17 reliability moals among the JTF17	2:
PORT rt to date (through	•	completed previously (event 10). 2. Reliability appartionment must be com- pleted previously (event 11). 3. Nathematical model is complete when criticality listing is published.	•	aubsystems and parts, as shown on the reliability block diagram, event 15. Requires updating as program Progresses it more effort is required on a subsystem. Apport imment is subject to completion of reliability block diagram (eyent 15).	12
uplation of parts in a subsystem, if. Updated to		FAILURE NODE AND EFFECT AMALYSIS REPORT - Insurance of failure mode and effect analysis report. Lecuance of report, Event 10 must be completed		Accomplishment is denoted by insumice of the apportioned subsystem and engine reliability gists (fatlutes/1900 hours),	23
CALINIS LIAI TAILURE modes of (MATES Shown on the	14	Prior to report being prepared. REMINIMUMAL RESIGNATIVE REPORT Reliability progress report to date (through 1967).	16	MATHEMATICAL MERGE. A computer program which apportions the reliability requirement of a system to the components and subsystems. The apportionment to based on the probability of component failure and conditional failure of massion due to	
m, ment 9, considering v. Includes, tailury lise and afterate, method required, design philose Jacard Lessification use hazard. Fafture is updated wech time J and at least purpy-min hide and offect analysis of current blow diagrams	B	RELIABILITY SLOCK DIAGRAM Diagrams should just a relation of parts in a component, exemples in a deservious, sed sujanotums. The JECT: The diagrams have updated to reflect latest design. Issu- block diagrams.		component facture. 1. Fatture mode and effect asserts must be completed newtownly (event 18). 2. Heliability appartishment must be completed provincely (event 17). 3. Mathematical model for complete when existentially listing is published.	
completion of analysis.	f^*			- · ·	

RELIABILE Reliabili at test a a reliabi from at Project of Completio from SST abilities finalized

FATURE P Insudance report. Issue to prior to

SEMIANNUA Reliabis Isaue rep RELIABILI Disgrama in a craps and subav are update Isaus blo

FATELIAR IN An analys on all Ji the reliad considers in index. In the reliad cross and in the same and in agrains, in the same and in agrains, in the completion of prompletion and prompletion and prompletion and prompletion and in the same and in agrains, in the same and in agrains, in the same and in agrains, in the same and in the



CONTINUOUS BELIABILITY DATA PROCESSING

CONTENEDUS POCUMENTATION OF PAST EXPERIENCE

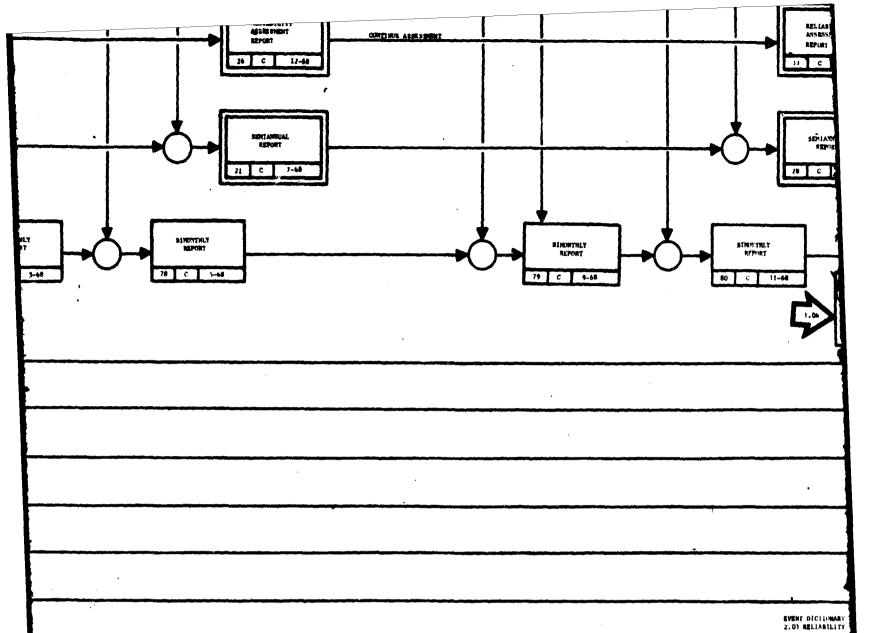
CONTENUOUS RELIABILITY SPECIAL STUDIES

CONTINUOUS TRADEOFF STUDIES

CONTINUOUS RELIABILITY ANALYSIS

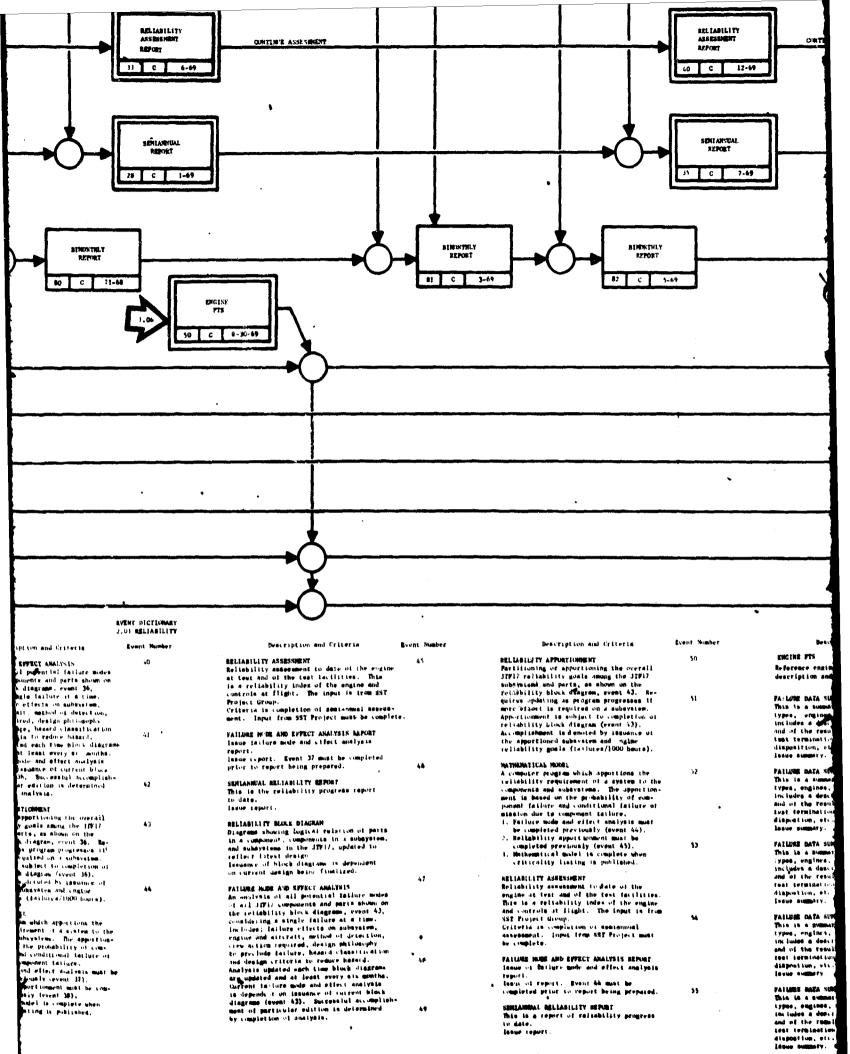
CONTINUOUS DESIGN REVIEW

Event Humbur	Beacription and Criteria	Even: Number	-	Description and Griceria	Event Number	• Nacripti	on and Criteria
10	RELIABILITY ASSESSMENT Reliability assessment to date of the engine at test and of the seet facilities. This is a saliability index of the engine and cor-	74		RELIABILITY APPORTIONMENT Fartitioning or apportioning the overall JFB17 reliability goals emeng the JFB17 subsystems and parts, as shown on the	2 A	SEMIAMUAL RELIABILI Reliability programa Isaus report.	
	A reliability look of the engine and con- trole at flight. The input is iron SST Project Group. Completion of seminanual assessment. Input from SST Project must be complete. Reli- ability assessment procedure must be timalized (event 7).	-2		reliability block diagram, event 22. Requires updating as program progresses if more effort is required on a subsystem. Appentionment is subject to compliction of reliability block diagram (event 22). Accomplishment is denoted by issuence of the apportioned subsystem and engine	29	in a component, comp and subsystems in the dates to reflect lat	ical relation of part ments in a subsystim o JTF17, which are est design. agrams is dependent o
,70	FAILING MUCK AND EFFECT ANALYSIS REPORT Insuance of failure mode and effect analysis report. Issue report. Event 16 must be completed prior to report being prepared.	25		reliability goals (failures/1000 hours). MATHEMATICAL MODEL A computer program which appurtions the reliability requirement of a system to the	10	of all JTP17 compone the reliability bloc	ECT ANALYSIS ocential failure mode nts and parts shown o k diagrams, event 29, isilure at a time.
21	SEMIANNAL RELIABILITY REPORT Reliability progress report to date. Issue report.	•		components and subsystems. The apportun- ment is absed on the probability of com- ponent failure and conditional failure of mission due to component failure. I. Failure mode and effect analysis must	e.	lm ludes; failure et angine and aircraft; gram action required to practude failure;	tects on substitum, method of detection, design philosophy hazard classification
72	BELLABILITY BLOCK DIAGRAM Diagrams showing logical relation of parts in a component, components in a subsystem, and subsystems in the JTF1/. Block diagrams are updated to reflect letest design. Levus block diagrams.	•		be completed previously (event 23). 2. Reliability apport ionsent must be com- pleted previously (event 26). 3. Mathematical model to complete when criticality listing to published.	•	are updated and at l Current tailure mode ta dependent on test dragrams, event 29.	wach time block diagi wast every six months and utiect analysis ance of current block Successful accessit
23	Patible MODE and REFECT ANALYSIN An analysis of all potential failure modes of all JIFIF components and parts shown on the reliability block diagrams, event 22, considering a single failure at a time. Imitudes, failure effects on subsystem,	26		RELIABILITY ASSESSMENT Reliability assessment to date of the engine at test and of the test facilities. This is a reliability index of the engine and con- trols at hight. The taput is from SST Project Group. Criteria for successful accomplishment is completion of armiannual assessment. Input		by completion of and RELIABILITY APPONITE Partitioning or apportished type of a roll particular appoint	
	engine and aircraft, method of detection, crew action required, design philosophy to preclude failure, hazard classification and design criteria to reduce hazard. Failure made and effect analysis are updated each time block diagrams are updated and at least every six months. Current failure mode and effect analysis in dependent on issuance of current block diagrams, event 22. Successful accomplighment of particular methods determined by	n		tron SST Project must be complete. PALLIES MIDE AND EPECT AMALTAIS REPORT ISSUE of failure mode and rifest analysis teps (issue of report to criteria for accomplishment, Event 23 must be completed prior to report being propared.		program programmes on a subsystem. Apportionment is mul reliability block d Accomplishment in de the amortioned subs	if more effort 16 requirement to completion of lagram (event 29). Hoted by issuance of
	completion of emelysis.					ě	•

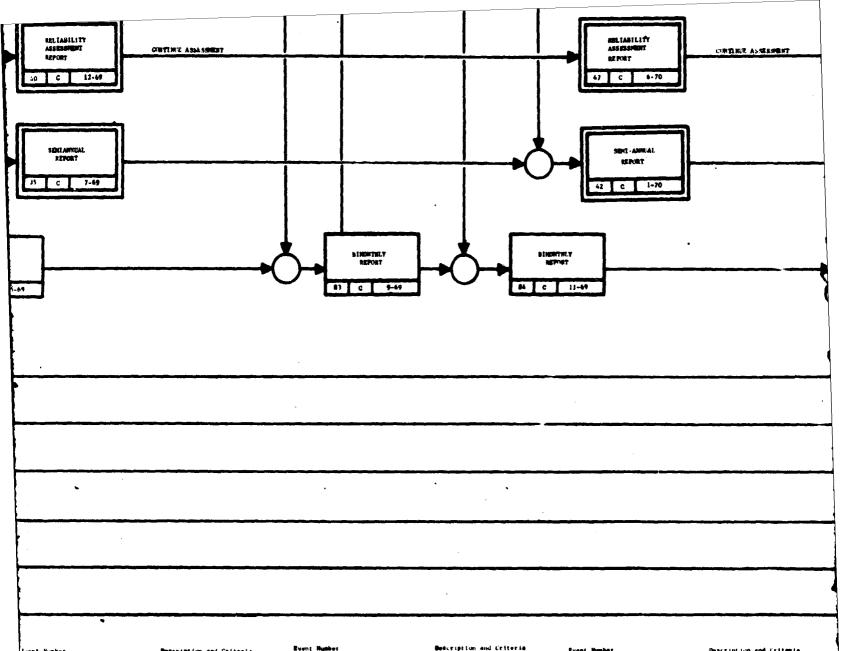


					4	. O) MELINBILLIS
	Description and Oricorta	Event Number	Descript on and Criteria	Event Number	Description and Gritoria	Event Mumber
	SENIANUAL BULIABILITY REPORT	32	MATHEMATICAL MODEL	37	FAILURE HODE AND REFECT ANALYSIS	40
	Restability progress report to date.		. A computer program which apportions the		An analysis of all purential failure modes	
	lanue report.		reliability requirement of a system to the		or all JTF1/ components and parts shown on	
			components and subsystems. The apportion-		reliability block diagrams, event 36,	
	RELIABILITY BLOCK DIAGRAM		ment is based on the probability of compo-	_	considering a single failure at a time.	
	Disgrams showing logical relation of morta		nent fatture and conditional failure of		Includes; tailure offects on subsystem,	
	in a component, a emponents in a subsystem,		mission due to component isiture.		engine and streratt, method of datection,	
	and subsystems in the JTV17, which are up-		 Failure mode and effect analysis must 		crew action required, design philosophy	4
	dates to reflect intent design.		be completed previously (event 30).		to proclude failure, hazard classification	
	tanance of block diagrams to dependent on		2. Reliability apportionment must be con-		and design criteria to reduce hazard.	41 '
	current design being finalized.		plated praytounly (event 31).		Analysis is updated each time block disgrams	
		•). Mathematical model is complete when		are updated and at least every six months.	
	FATURE HODE AND EFFECT ANALYSIS		eriticality linting in published.		Current fatture mode and effect analysis	
	An analysis of all potential fatture modes				is dependent on issuance of current block	
	of all ITTI7 components and parts shown on	33	RELIA GILLITY ASSESSMENT		diagrams, event 36. Successful accomplish-	
	the sultability block diagrams, event 29,		Reliability assessment to date of the weighte		ment of particular edition is determined	42
	considering a single failure at a time.		at test and of the test tacilities. This		by completion of analysis.	
	im judes; intlure effects on subsystem,		in a reliability index of the engine and	•		
	engine and aircraft, method of detection,		controls at thight. The input is from \$87	36	RELIABILITY APPORTLONGENT	
	cree action required, design philosophy		Project Gruup.		Partitioning or apportioning the overall	
	to practude faiture, basard classification		Completion of semiannual assessment is		JTV17 reliability goals among the JTV17	43
	and design criteria to reduce hazard.		criteria. Input from SST Project must be		aubaystems and parts, de shown on the	
	Anxivete is updated each time bluck diagrams		complete,		reliability block diagram, event 36. Re-	
	tre updated and at least every six months.				datas abque ent us broften broftensus ft,	
	Current tailure unde and ettert analysis	34	FAILURE HODE AND REFECT AMALYSIS REPORT		more effort in required on a subsystem.	
	is dependent on issuance of current black		inquance of failure mode and effect		Apport forment is subject to completion of	
5	diagrams, svent 24, Successful sccomplishe		anlaysia report.		reliability block diagram (event 36).	
	ment of particular edition is determined		Criteria in insumme of report. Event 30		Accomplishment is denoted by insusace of	
	by completion of analysis.		must be completed prior to report being		the apportioned subsystem and engine	44
_	• • • • • • • • • • • • • • • • • • • •		prepared.		reliability guelo (failures/1900 hours).	
•	HELIABILITY APPENDIAMES					
	Part tronting or apportioning the overall JPT1	/ 35	SEMIANNUAL RELIGIBILITY REPURT	19	HATHEMATECAL MUSEL	
	settability goals among the 12917 subsystems		This report is the reliability progress		A computer program which apportions the	
	and parts, as shown on the reliability block		cuport ta dato.		reliability requirement of a system to the	
	diggiam, event 29. Requires updating as		lucue report.		components and autopatems. The apportion-	
	program progresses if more effort in required				ment to based on the probability of com-	
	on a subsystem.	3	RELIABILITY BLOCK DIAGRAM		purent failure and conditional failure of	
	Apportionment is subject to completion of		Diagram showing logical relation of parts		mission dur to component failure.	
	reliability block diagram (event 29).		in a compenent, components in a subsystem.		i. Vailure mode and effect analysis must be	
	Accumplishment is denoted by tenuence of		and aubayetome in the 37917, updated to		completed proviously (event 37).	
	the importioned subsystem and engine	•	reflect latest design.		2. Reliability apportiument must be con-	
j	reliability quais (failures/1000 hours).		Inque bluck diagrams.		placed previously (event 36).	
	-		•		1. Hithematical model to complete when	
					criticality listing is published.	

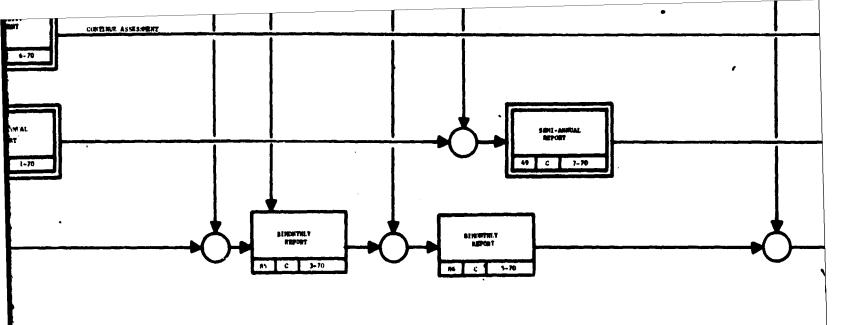
Control of Management



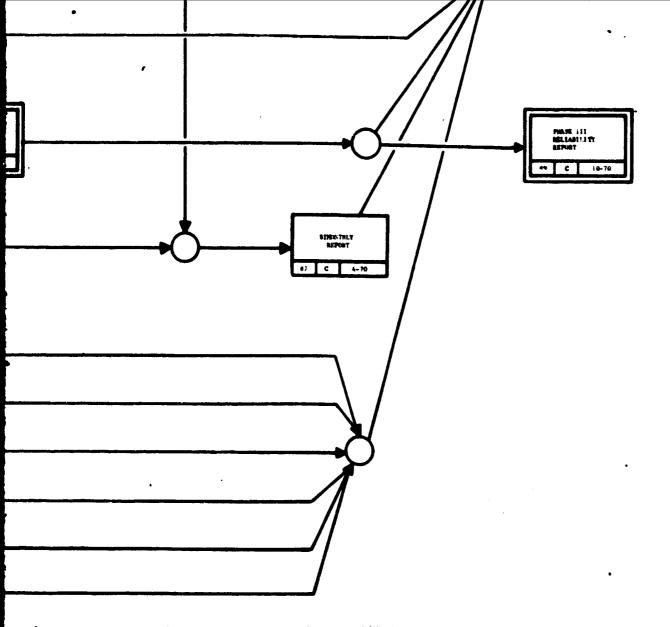
This is a copert of reliability progress to date.
Issue copert.



Lygat Number	Bookription and Criteria	EVANT MUMBER	montriprion and criteria	Event Humber	Spacript ion and Critoria
50	ENCINE FTS	56	FAILURE DATA SUMMARY	61	PATLUME DAPA SUMMARY
•	Reference engine naturals 1.06 for		This is a summerization of failures by		this is a summer tretten of factures by
	description and criteria.		types, engines, sequence, etc. This		types, sugines, sequence, etc. This
	description one criterie.		includes a description of the lailures		includes a description of the failures
			and of the regulin, such an, unscheduled		and of the results, such as, unarheduled
51	FAILURE BATA SURMAY		teat termination, fatiure analysis, part		test termination, jailur analysis,
	This is a summirization of tailures by		disposition, etc.		part dispusition, etc.
	types, engines, sequence, etc. This		lunue nummary.		Inoue aumary.
	includes a description of the failures				100.00
,	and of the results, such as, unscheduled	97	FAILURE DATA SUMMARY	42	FAILUME BAIA SURMARY
ł .			This is a summerisation of tailmes ?	4.	This is a summerisation of failures by
7	test termination, failure analysis, part		types, engines, sequence, etc. This		types, engines, sequence, . to This
,	diaposition, str.		includes a description of the tallures		includes a description of the fallures
	itane summery.		and of the tenults, such as, unatheduled		and c: the regulat, such as, unacheduled
1			test termination, failure analysis, part		test termination, failure analysis.
12	PARLURE DATA MUROPREY		disposition, etc.		part dispression, ess.
Į.	This is a summerisation of failures by		leave summery.		
1	types, engines, sequence, etc. This		(1415 -		latte authory.
1	includes a description of the failures	10	PATELINE MATA SUMMERY	44	Maria and Address of the Control of
	and of the results, such as, unachedules	74	This is a summarization of tactures by	4)	PAILLINE MATA SHOWAY
•	tout termination, fatlure analysis, part		types, engines, sequence, etc. This		then in a number tent school to the force my
)	dispustion, etc.		includes a description of the failures		types, engines, sequence, esc. This
)	Lacus suggesty.		and of the results, such as, unscheduled		includes a deacysption of the tailus on
					and of the results, such as, unschadible
13	FAILURE BATA SURGARY		test termination, failure analysis, port		test termination, intiure empires, part
)	This is a summerization of failures by		disposition, ett.		diapostion, etc.
I .	lypot, engines, toquette, etc. Itia		leave summary.		incur tuga.
	includes a description of the failures				•
	and of the results, such as, unasheduled	>9	PALIJER DATA SHOWLY	•	FAILURA GATA EUPOMANY
La Company	test termination, failure shelvein, part		thin is a summerisation of failure by		this is a summerication of tactures by
	diamention, etc.		types, engines, sequence, etc. Bils		types, ungines, sequence, sec. This
1	Inque numary.	•	includes a description of the failning		includes a description of the telleres
•		-	and of the results, such as, unscheduled		and of the secults, such so, unechestifed
h u	PARLINE DATA SURBAY		toot termination, failure analysis, part		took tormination, tailure analysis, part
7	This is a summerization of failures by		di apos ition, etc.		diaposition, etc.
l .	truck, routers, sequence, vic. file		lague dumatry.		Same summery.
	includes a description of the failures				
1	and of the requite, such as, ungeheduled	60	PALLUME MATA NYOMEY	65	PAILMER BAIA HUGGARY
1	test termination, fatiure engirate, part		This to a summerisation of tailures by		This to a cummarisation of fatigies by
· i	disposium, etc.		types, ungines, toquence, utc. Mis		types, engines, sequerer, etc. this
	land sumery.		includes a description of the fallures		Itte fudua a donce totte er eit the faitures and
1.	10100 0-00-17		and of the results, such as, a schoduled		of the results, such to unacheduled tout
Y ,,	PAILMER BARA SUBBARY		test terminatium, fatiure ambiyeis, part		termination, taxing civata, sate
133	This is a supportantion of failures by		diaposition, etc.		dispublition, etc.
l l	types, engines, sequence, etc. This	•	teens summery.		latur tumbry
	includes a description of the failures				
•					
)	and of the regults, such as, unacheduled				
i	test termination, tatture enalysis, part				



Description and critical	Event Number	Bracription and Eritoria	Event Mapher	Brace Lpt ion and Describe	Event Number
FAILURE DATA SURMARY This is a summer control of darking by types, ongaines, sequence, etc. this includes a description of the includes and of the results, such as, man-heduled test terminations, failure analysis, pair disposation, etc. tenue summers.	16	TAILING DATA SHORARY This is a summerisation of tailures by types, engines, sequence, etc. This ascludes a description of the failures and of the results, such as, unphuduled test termination, failure mainsis, part dispinition, etc. Is one summary.	71	PALLING SAIN SURGERY This is a summer that has of latteren by types, engines, sequence, etc. This im ludes a description of the lattere and the results, such as, unacheduled test termination, failure analysis, part deposition, etc. Laue summery.	76
FAILING DAIA SUBMENTY THE IN A GAMENTAL STATE BY THE IN A SUBMENT PARTY OF THE BY THE INTEREST OF THE	6 7	FALLING BATA SUPPLIES This is a summarisation of failures by come, segimes, sequence, oit. This is also a less terminal to the failure out of the position, such as, unacheduled two termination, failure engines, part disposation, etc. Laur summary.	n	PAILMR GATA SUBSTANT This is a summerivation of inciden by types, engines, sequence, etc. This includes a description at the facture and the results, such as, unacheduled test termination, tailure analysis, part disputcion, etc. Index outsides.	eo
FAILURE DATA Without This is a compartication of table on by Sympa, ong. or a poquent of table on by Sympa, ong. or a first as and of the fraults, and the manufaction of the failure of the travity of the fraults, and the manufaction of the fraults, and the fraults, and the manufaction of the failure in the first of the failure in the failure.	tu	PARLIMS MATA SUBBLEY This is a dummeritation of failures by types, engines, inquestor, etc. This includes a dustription will the latitude and it the results, such me, unichestales	23	Bi-Marilly Paradica merupy love a bi-monthly reliability progress report in accordance with Mass III Proposit lose report	9)
dispusting of:. Isnur summety.		tost terminetium, toliure amalumis, part dispusitium, etc. igamo bumbity.	74	Bl-MaiStry Populatis plying Loons a bl-manthly syllability program supert in decordance with Mage III	u
FALLING DATA SUBSCRIPT This is a summer continual tertury by types, continue, second or etc. This	44	this to a supportant too of latiness by		Priposal. Issur reputt	
Instants a description of the calleres on at the calleres on the terminal terms to the caller of the following terms to manufation, factors analysis, as tart disposition, etc., to the caller of the calleres		types, onglings, sequence, etc. This includes a dutit intim of the father and the results, such as, unachaded too" tersination, facing ensignit, part disposition, etc. Inner semmery.	n	Al-Mairinty Pourages at Publy Issue a bi-conthly reliability program report in accordance with Mase IIS Proposal. Issue report	. 4)
PAILIMS Data SUSBANT This is a commarisation of far tracks type, engines, sequence, etc. This includes a fearing to the fartire did of the results, but is not-bedued to- termination, failing emblest pers	76	Values that appears of fallings by types, so these that two of fallings by types, so these, equency, or. This includes a description of the falling and the souther, such on, unachedoled	16	nt-manuary Parametes adoptive as a second program of the second program of the Point St. Proposal force of the second proposal force or point.	•
dispusition, dir.		test termination, failure analysis, s part disposition, etc. [tuos summers	13	ot-morthly foreigns adjust toom a bi-doublip reliability program report to averager with those III frigment. lease resert.	to .
	•	•			



Beautiption and Criteria	Event Number	Dogs ription and Criteria	Event Rusha	Special um and Critoria
UPRE BATA SHOWARY	78	BE-MANTHLY PROGRESS REPORT	******	
a to a bummer continue of tallures by		lasm a bi-monthly reliability progress	•	AL-MENTALY PROGRESS METURE
PR. PREIROR, SHEWARLE, MILL This		remote in accordance with those III		lacue a st-mouthly reliability progress
ludes a description of the falloge		Fromesi		report in accordance with Phase III
the coults, such as, unschoduled		issue report		Proposal.
terbination, tallure enginess.		took taket.		thour report.
t desposition, etc.	19	BE HAND THEY PROMINENT OFFICE !		
to establey.	,•	large a biomorbly reliability progress	67	DI-MENTALY PROGRESS DEFFOR
				from a be-munchly relability progress
LUGE DATA MARMAY		expect in acceptance with Phone III		romet in accordance mach Phase 121
		Proposit.		Premise!
to a summerication of reliefes by		lanc topal		leter report.
no. continue, companie, etc. Tito		· · · · · · · · · · · · · · · · · · ·		
ludes a description of the fatiuse	₩0	ST-WELLIFF LEWINGER BELIEF		
the teautte, such as, unerhoduled		toon a bi-mouthly spisobility progress -	•	CONSTITUTE OF STREET,
teralmeten, tellure maliete,		epport in accusadence with Roser III		LOS-MOVE PLOOF TOOT
i dispusition, st.		Perspendit.		and of Phone III, Completion of 100
or states y.		Labor tepots		hours of flight testing.
SHIFTER PRODUCTS NEVERT	al	MARKET PROMISE SERVE		
or a hi-machin reliability progress		lowe a hi-monthly relighting programs		PROME IN BOLISALLITY BEFORE
ort in moutance with Phone 111		comet in accordance with Phone Itt		This to the final milebillin beart to
mat.		Promosi.		he toward with the Phote III Plant Breast
ur report		latur toput		from report,
radifica Panagas adrens	62	BE-MINITELY PROMINENT METHOD		
or a bi-mouthly ipliability progress		tone a historithic relightitie progress		and the complete of the comple
will in accordance with these 121		propert in accordance with Phone Ill	•	BREAT CHITTPTCATA
meal.		Proposal		Reference region aptwork 1.86 for
réport-		lance toposti.		dedictipation and criticals.
MARTINEY PROBLES IN PURT	41	AL-MAN PALT PROMINES ARPHAT		
us a bi monthly reliability progress		them a bi-monthly reliability progress		•
ett in ecceptore with flage 111		commet in accordance with Photo III		
pre\$1		Programa 1		
ne talet		Ename Copert.		
MATTER FROM A METERS		Parameter Parameter HEPAT		
w a bi-mathly tritability gragings	-	team a hi-mathir reliability strategy		
nit to defendence with Phase 111		rement to incordance with Photo III		
with the distantance after brook \$15				
		Proposi.		
topet.	•	labor tofict.		·
ISM DET PRICES E ISPANT	e n	of-master's tendence appeal.		
ur a bi-walki, teltabiliza pragress		loom a bimmably reliability programs		

662908 FD 17838

Pratt & Whitney Aircraft

PWA FP 66-100 Volume V

2.04\ QUALITY ASSURANCE

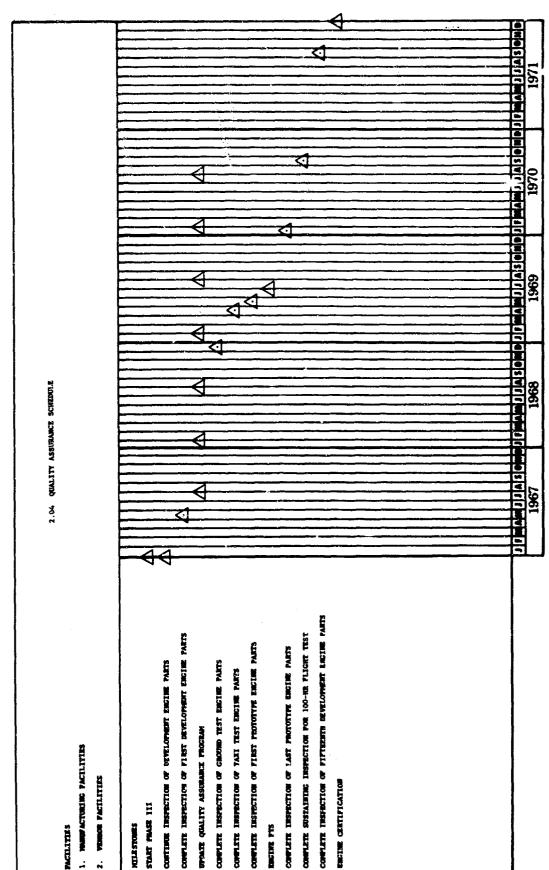
The Quality Assurance program, described in detail in Volume IV, Report F, Section III, defines the Quality Assurance organizational responsibilities and accomplishments to assure that all quality requirements are incorporated in the engine from initial design through final test. The necessary documents to establish the requirements and guarantee compliance are a part of the program.

Quality Assurance is closely associated with scheduling of individual parts, assemblies, and completed engines. The time phased requirements will be Quality Assurance Data Sheets (QADS), Inspection Methods Sheets (IMS), Engine History Record Sheets (EHRS) and special inspection tooling. The time schedule for each part and assembly varies throughout the engine build cycle and therefore no single time phased requirement is possible.

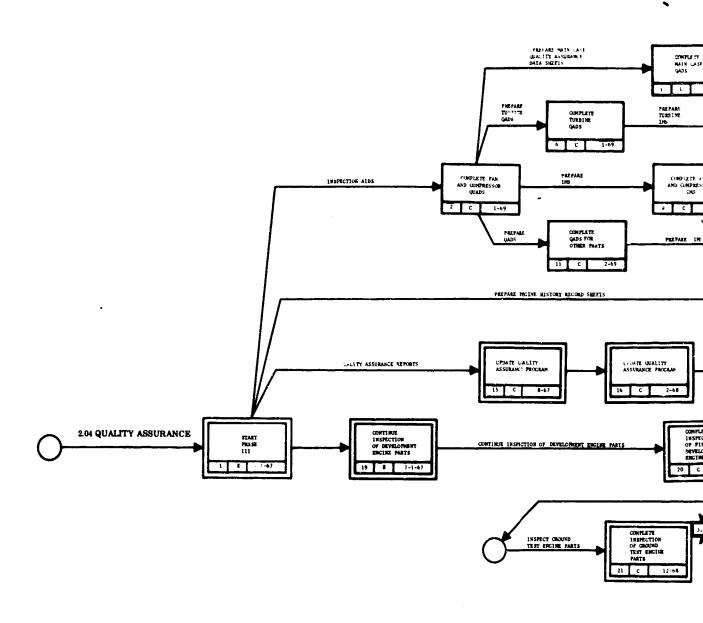
The major milestones, network chart and event dictionary for quality assurance are shown in figures 5 and 6, respectively. Test planning and integration of quality assurance is presented in Test, Volume IV, Report E.

Pratt & Whitney Aircraft
PWA FP 66-100
Volume V

7 FD 17883



2.04 Quality Assurance Figure 5.



Event Number	Description and Uniters.	Event Number
ì	START OF PHASE III Start of Phase III Phase III go-shead	6
7	COMPLETE FAN AND LUMB	7
3	COMPLETE MAIN CASE QADS Complete the preparation of Quality Assurance Data Sheets for JTF17 main vases. Issue the QADS	8
	COMPLETE MAIN CASE INS Complete the preparation of Inspection Methods Sheets for JTF17 main cases. Issue the INS.	4
,	COMPLETE MAIN CASE SPECIAL GAGES Complete the special gages required for inspection of ITF1/ main cases. All special gages available for use.	10

COMPLETE TO COmplete th to Shoots the QADS

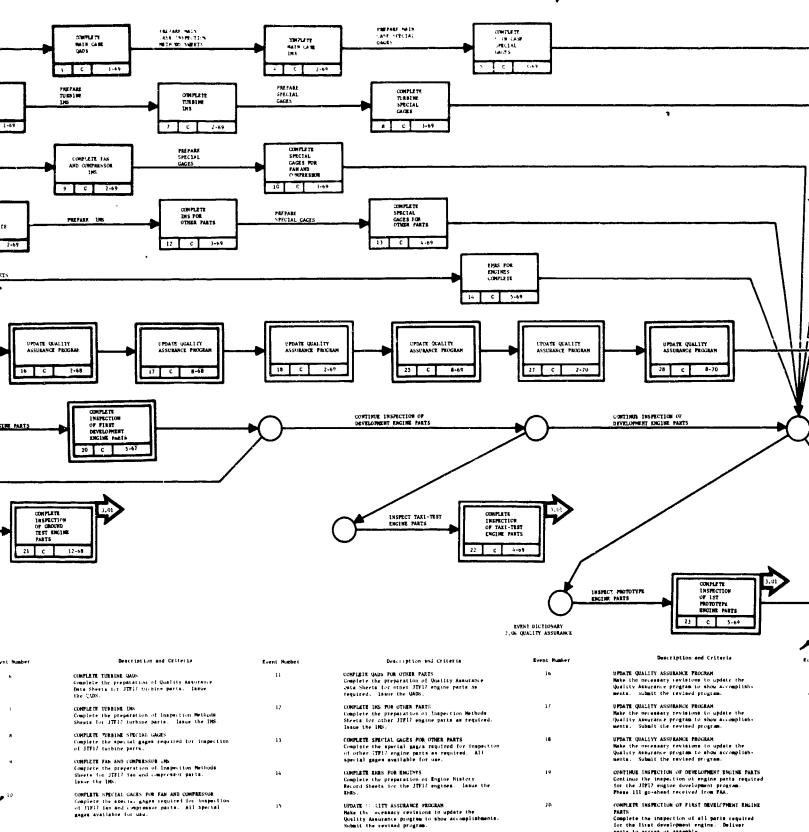
COMPLETE TO Complete th Sheets for COMPLETE TO Complete th of JTF17 to

COMPLETE FA Complete th Sheets for Issue the 1

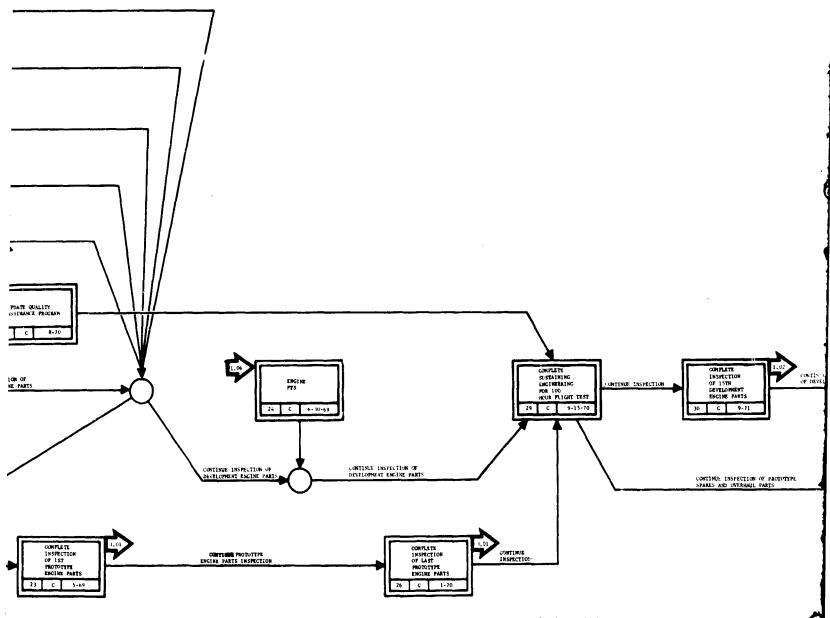
COMPLETE SP Complete th of JTF17 to gages avail

Figure 6. 2.04 Quality Assurance

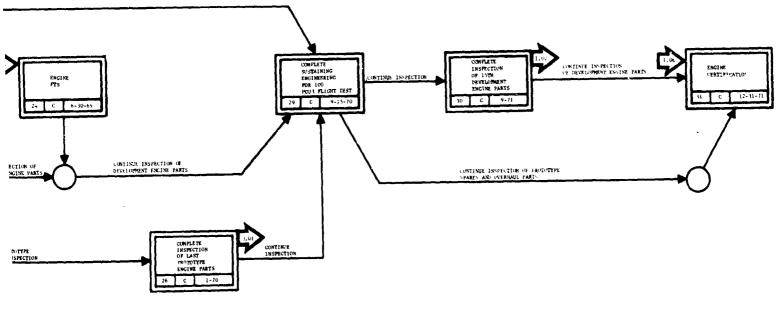
2.04 Quality Assurance



PARTS
Complete the inspection of all parts required
for the first development engine. Deliver
parts to stores or assembly.



heactiption and Utiteria			Event Number	Description and Criteria
Carrier and Control	Event Number	Description and Criteria	Event Mumner	• •••
ASSURANCE PROGRAM	21	COMPLETE inspection of emotion TEST Engine PARTS Complete the inspection of all paids required for the last acc — engine. Deliver parts to atomic of desembly.	26	COMPLETE INSPECTION OF LAST PROTOTYPE ENGINE PARTS On the the stage of all pasts required or she last prototype engine. Desc. c. pasts to stores or assembly.
ASSUBANCE PROGRAM ATTY revisions to update the to upogram to show accomplish- the revised program.	Ω	COMPLETE INSPECTION OF TAXI TEXT EXCINC PARTS Complete the imagestion of all pirts required for the last taxi test engine. Deliver parts to stores or assembly.	27	UPDATE QUALITY ASSURANCE PR GRAM Make the necessary revisions to update the Quality Assurance program to show accomplishments. Submil the revised program.
ASSURANCE PROGRAM Lary Levisions to update the Lie program to show accomplish- the revised Program.	73	COMPLETE INSPECTION OF PIRST PROTOTYPE ENGINE PARIS Complete the imspection of all parts required for the first prototype engine. Deliver parts	28	UPDATE QUALITY ASSURANCE PROGRAM Make the necessary postsions to update the Quality Assurance program to show accomplishments. Submit the revised program.
TION OF DEVELOPMENT SMALLS PARTS supertion of engine parts required engine development program.	24	to minter of aumembiv. ENGINE PTS Reference engine metwork 1.06 for description	29	COMPLETE SUSTAINING ENGINEERING POR 100-HOUR Filed TEST End of Phase 111. Completion of 100 hours of High testing.
ction of view of the parts required	25	and citeria. UPDATE (Mattry Assurance PROGRAM Habe the necessary revisions to update the Quality Assurance program to show a compilablements. Substi	w	COMPLETE INSPECTION OF 15th DEVELOPMENT ENGINE FARTS Complete the inspection of 411 parts required for the 15th development engine. Deliver parts
development engine. Delive: a of assembly.		Assurance program to some accomplianments. Annual the revised program.	11	to stores or assembly. ENGINE (ERRIFICATION Reference engine network 1.06 for description and criteria.



Description and Criteria Event Number In INSTRLIGN OF GROUND TEST ENGINE PARTS In the inspection of all parts required In last ground dest engine. Deliver parts Final parts required In last ground dest engine. Deliver parts In the inspection of all parts required In last case of assembly. Final parts tradition Final parts tradition
Description and Oritetia Event Number
In Interpretation of all parts required Complete the temperature of all parts required Interpretation of all parts required Complete the temperature of all parts required Interpretation of all parts required Complete the temperature of all parts required Interpretation of all parts required Prof.
e the inspection of all parts required 1 Make the user swars revisions to splate it a spalical Make the user swars revisions to splate it a spalical Make the user swars revisions to splate it. Submit a spalical materials. E Describe OF EDEST PROTOTYPE ENGINE 28 Make the user assembly. PAGE TO ASSUMANCE PROTERM Make the user materials are revisions to ordate the spalical.
E INSECTION OF FIRST PROTOTYPE ENGINE 28 UPDATE SQUALLY ASSURANCE PROGRAM Make the insecurate revisions to consist or specially
o the imagnified of 44% parts o quoted the freshed program. Tarmi prototype engine. Deliver parts 24 CMMM RECOGNISE SUSTAINING ENGINEERING FOR 100-bot o color assembly. Story assembly.
Fig. End of Phase III. Completion of 180 house of thight texting. Forth, 30 COMPLETE INSPECTION OF CSTR DESCRIPTION.
AMAILY ASSUMANCE PROGRAM PARTY Complete the imposition of all parts required conversable training to object the shallsty to the lith development engine. Deliver parts For program to above accomplishments. Substit. Low divious or assembly.
33 RNGISK CRETIFICATION Reference engine network i.Ob tog deeralption and criteria.

Pratt & Whitney Aircraft

PWA FP 66-100 Volume V

2.05 VALUE ENGINEERING

The Value Engineering Program provides function-to-cost evaluation of all aspects of the supersonic transport engine program and is described in detail in Volume IV, Report F, Section IV. This program provides the following:

- 1. A value engineering director, who controls the integrated value engineering activities and functions.
- 2. An organization in key departments that utilizes functionoriented methods, procedures, equipment and personnel in a systematic effort to optimize or reduce cost.
- 3. A review of subcontractor drawings and specifications to ensure integration within the program.
- 4. A training program to indoctrinate personnel in value engineering.
- 5. A formal reporting system for documenting savings attributed to the Supersonic Transport Program and assessing progress toward target costs.

The functional approach applies to every department involved in the JTF17 program and, when integrated, provides maximum value from each program dollar.

The major milestones, network chart and event dictionary for value engineering are shown in figures 7 and 8, respectively. Test planning and integration of value engineering is presented in Test, Volume IV, Report E.

Pratt & Whitney Aircraft PWA FP 66-100 Volume V

FD 17884 VH

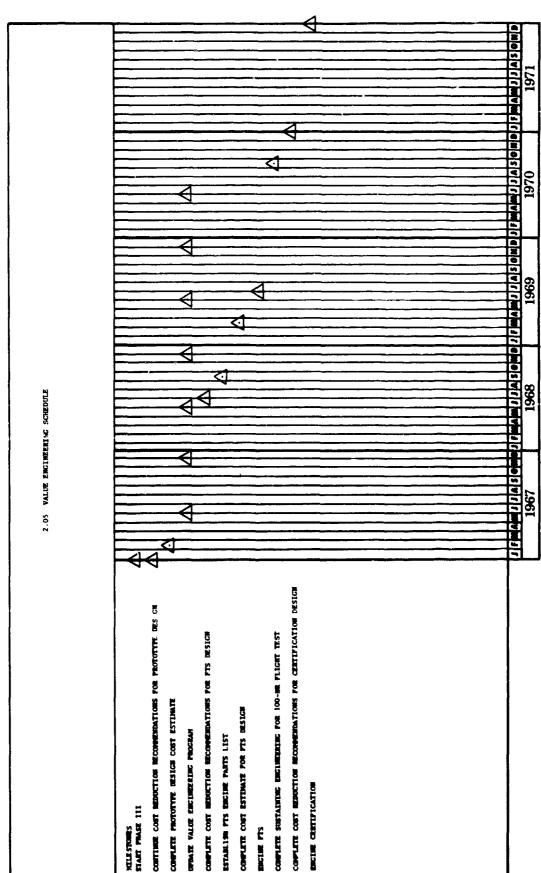


Figure 7. 2.05 Value Engineering

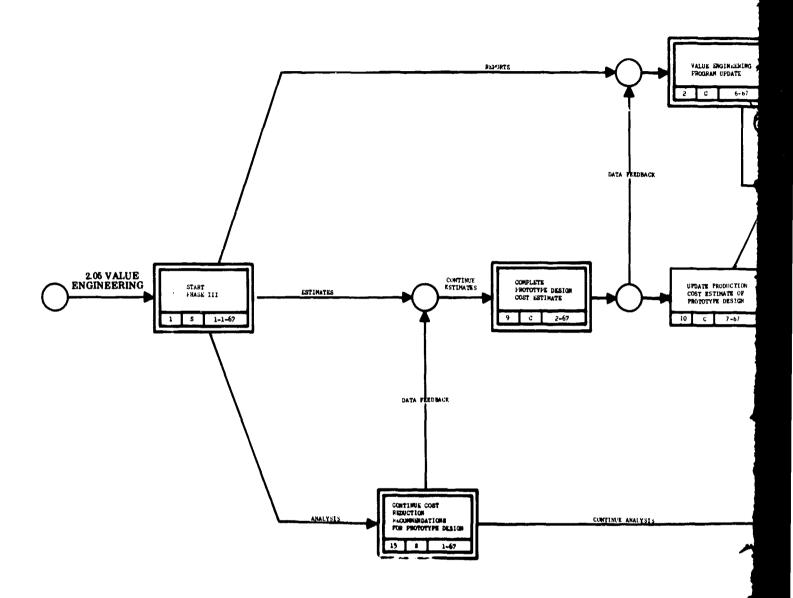
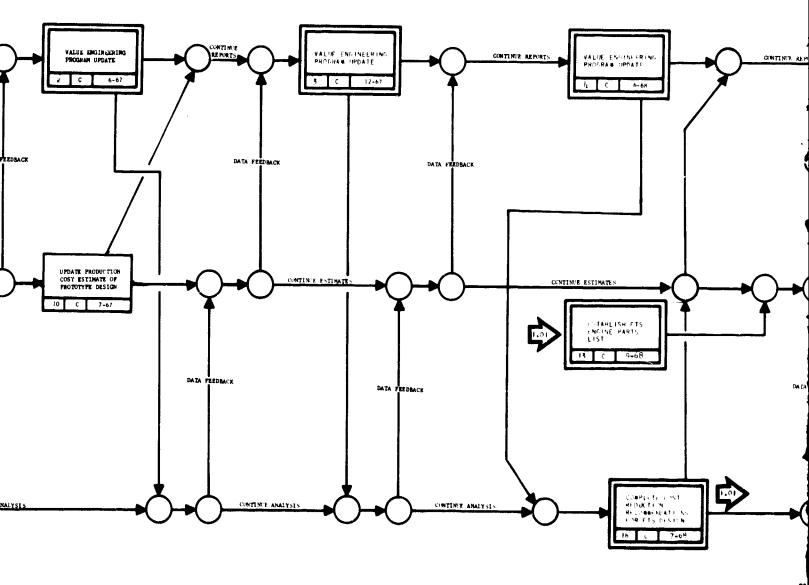
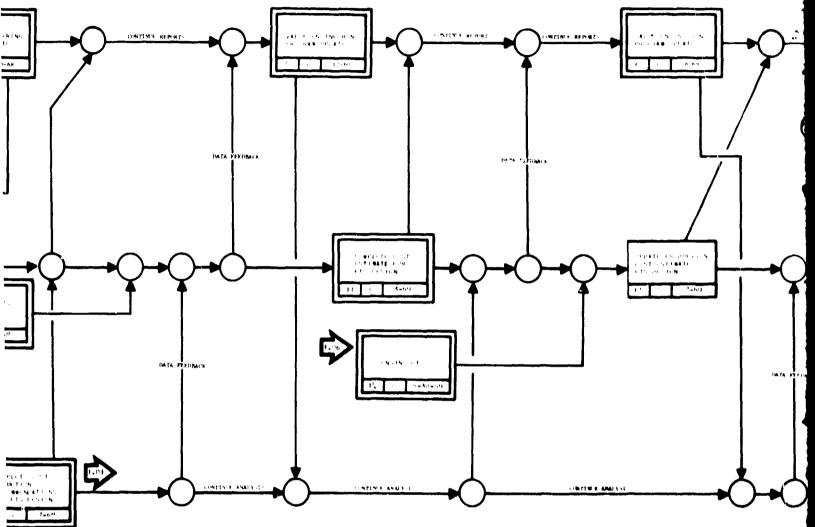


Figure 8. 2.05 Value Engineering



Kvønt	N code or a	Dence to the sent territoria
	1	START PHASE III
		Start of Phase III . Place II. a releast to stord
		Es - taa.
	:	VALUE ENGINERATED PRINCIPLE
		tale class changes to program. Or is a result of
		changes by the aughor dealgo, wherefore cost
		section because I fraction of report
	,	VALUE ENGINEERING PROGRAM CYBECK
		this state charges to passage or set on a sew-it of
		of angers to the suggine dealer and algoret cost
		enduction pengeces. Lieuwice f exposes
		ANTER BRITTABBUTAN ANTERNA CARPLE
		Kati alate i geigen bi ere penghan inib be a senitt
		of a fanger to the eighter beign and explet the
		and without progress of the spools of they let
	•	value employeeming resugate their
		make late atangra to program a con us a suit of
		into a transaction to a first a supplicable place and a section of the section of
		reduction progress. Throughts the court
		VALLE ENLINEERING PROBLEM COMES
		Paliniate changes in polynomic chies a result
		of changes to the organic design and confort cost
		todustion progress : explain of export

2.05 Value Engineering

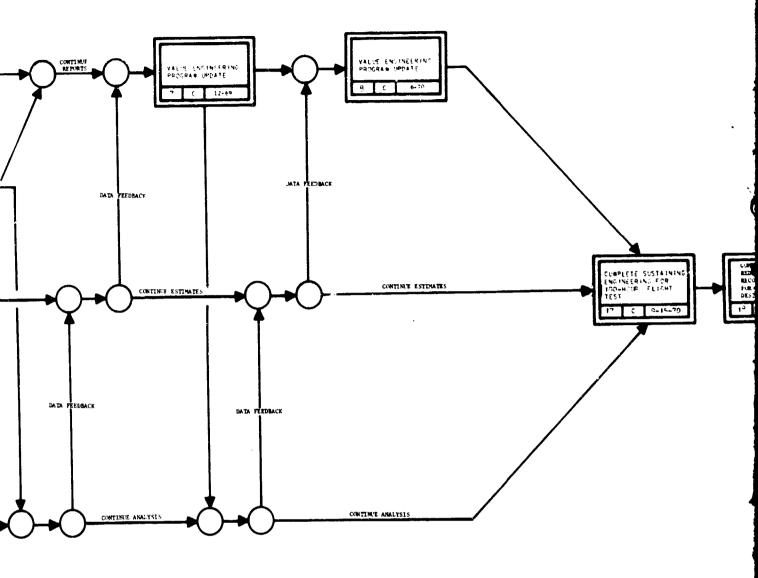


PARME DECEMBER COLUMN ROME ENERGINE

et i a fila e ka	Brest Branke
	•
Mary Control Williams	
Y -1463 B	
and the second second by the second	
y with the transfer	
a code speed	
*	
البعد فبيها ماكأ أومر	.1
الأن فسير ماديو	
1.04.97	
2 45421	
The street of the second stree	
The state of the s	
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	
1.4 4 4	
The second second second	
A 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	•
1795 8	
The second second	
فلاحد فقطهم واحتمام المراجي	
are a sub-innegered	

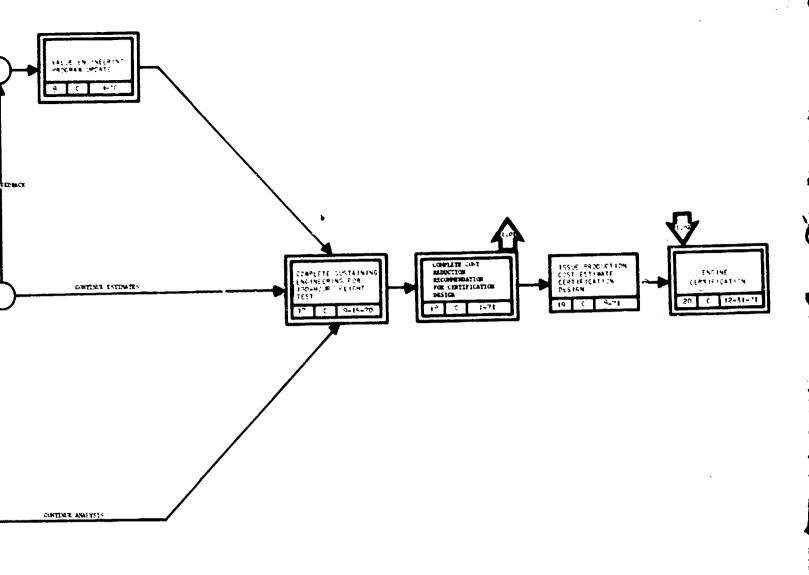
Depty pageta in assist to consta	Brent Carl
VALUE ENCORPRENCE CONTRACTOR AND OPEN PROPERTY OF THE PROPERTY	• •
CALCE PARCINERS OF ERROR FRANCE Sold And Control of the Control o	i e
 Programme of the control of the contro	
OFFERS PROMOTED COMESTICATED FOR EXPENSES OF EXPENSES WELL ON MARKET PROMOTED FOR EXPENSES OF THE PROMO	ŧ
INVESTMENT OF THE STANDARD FOR THE TABLE OF THE STANDARD OF TH	
i straje rejobe sijako i ose kiji tajanske pri i beloji ta 19. – Grej i je sovije i osi i sijako kiji i osije i i sovije 19. – Aroli i Birogolari	
erhabito fir bacing rabbusing are long at \$200 as a second at \$200	
Burnstalling Butters on a region of the relation of the control o	

	total and applicables of
partia. Grantaria, turia	ggy o tion and t omo space tomo given constitutions.
20 α Σφεί (- 16 3 − 6 π Ε - 16 - 16 παρουν πα 2 α π 1	gas regener de sir de roman. Talk
- week to the total	macemparate and the second of the second
	kykan de statisk fast fast som en er Visit fast som en er
Propositio in 1988) 25 deleter 1801	(क्युक्त) शहर के में के एक
# 1	eget (€ to the First)
indersprote in exist e cultinatele	Mise un les las l <mark>etimomisant</mark> iem elem lempopalsia elem
Fr. Sec. School	engan general and the several and the consequence of the group of the consequence of the engineering of the engineering of the engineering of the engineering of
	por la completa de la completa del completa del completa de la completa del la completa de la completa del la completa de la c
	er en
494.196 - 49717.5	LANGER Na na tagana (a. 1800 - Kalanda ya Kalanda
وي المعادية والواتية المعادية المراجعة	Management of the contract of



.-

·



FD 17833

2.06 CONFIGURATION MANAGEMENT

A Carlo March

Configuration Management is the system which controls the end-item configuration and provides engine and component part identification, engineering change control procedures and component and engine assembly accountability for the JTF17 and all Pratt & Whitney Aircraft commercial production engines. This system is described in detail in the Configuration Management Plan, Volume V, Report C.

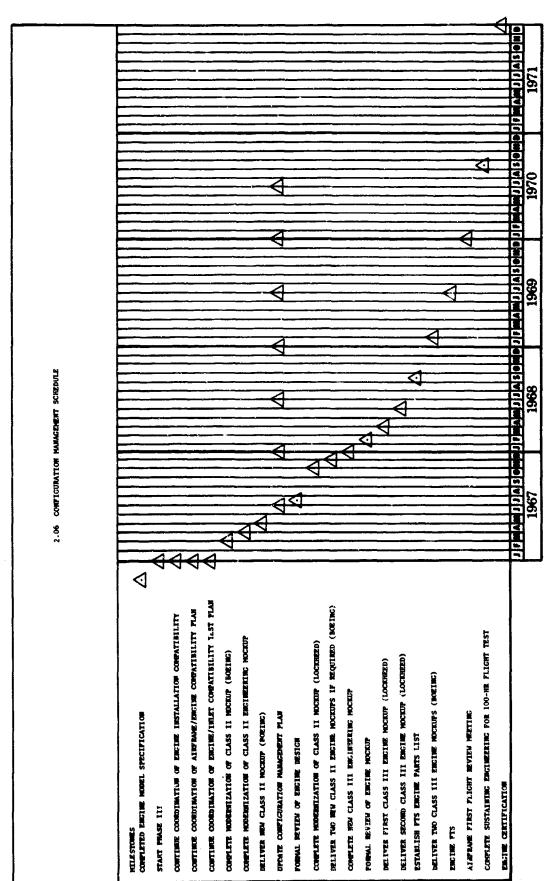
The Engineering Change and change control procedure is the heart of this system. All changes to the engine model specification, engine and components assembly parts list, and assignment of part and serial numbers are implemented only by approved Engineering Changes. The system is applied throughout the program from the initial design layout, through detailed design, development, production, follow-on development, and service life of the engine.

To assure complete compatibility between the engine and the airframe manufacturer the close liaison developed in Phase II-C will be continued. This starts with the preparation of the engine model specification and engine definition and implementation of the established working procedures with the airframe manufacturer. The baseline control for this coordination will be the engine Model and Performance Specification, including the Installation Drawings. The instruments for providing this coordination are Field Survey layouts, correspondence and the Engineering Change control procedures. Engine mock-ups will be manufactured for engineering design and airframe manufacturer coordination requirements. The latter will also serve as a fixture to confirm final nacelle installation compatibility.

The major milestones, network chart and event dictionary for configuration management are shown in figures 9 and 10, respectively. Test planning and integration of configuration management is presented in Test, Volume IV, Report E.

Pratt & Whitney Aircraft
PWA FP 66-100
Volume V

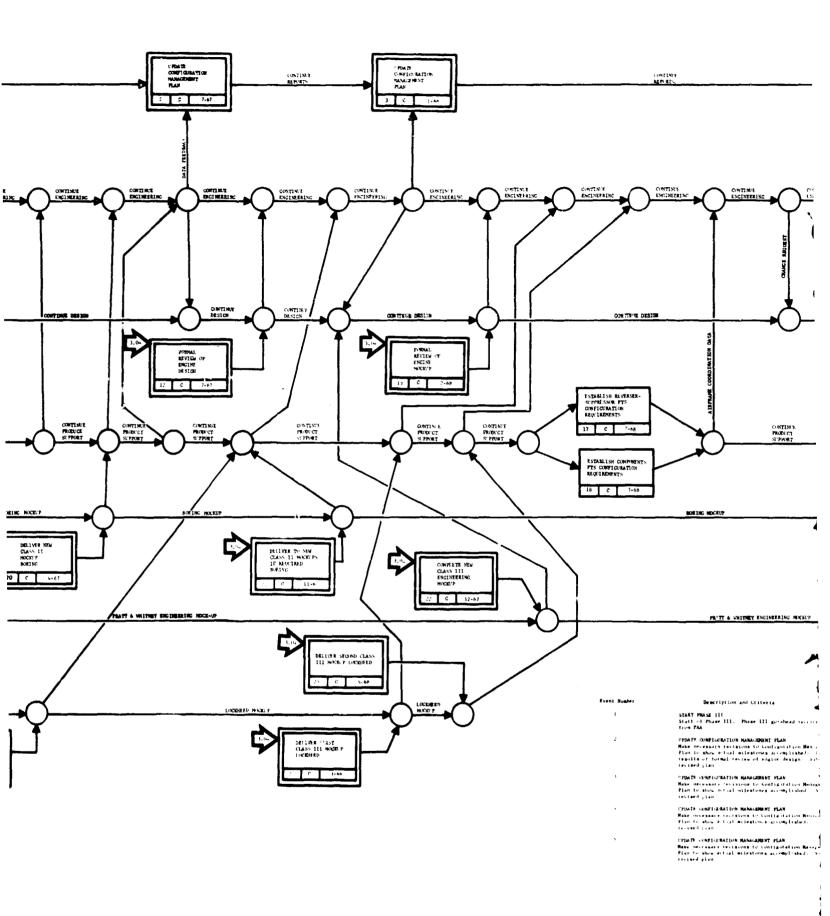
FD 17885



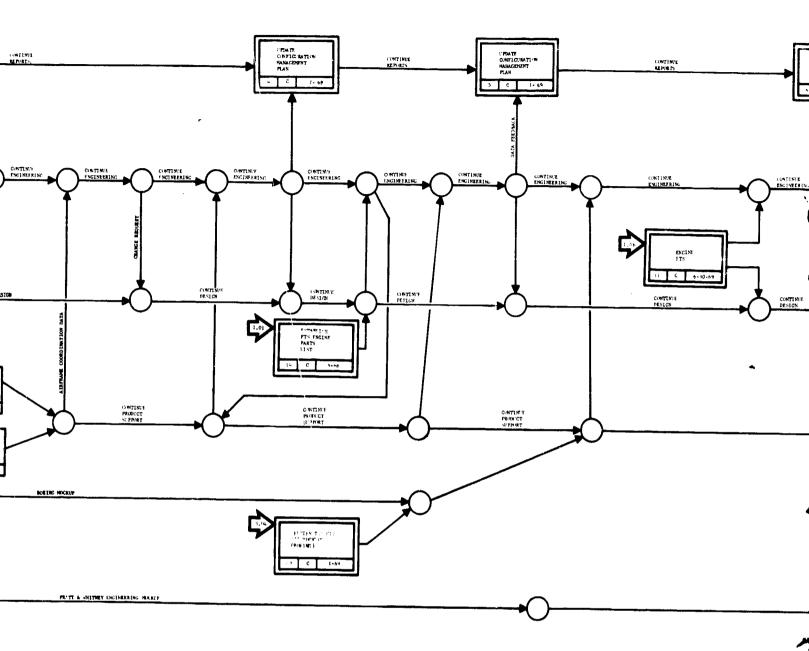
2.06 Configuration Management Figure 9.

COMPLETE MODERNIZATION CLASS II MOCRIP (LOCKHOLD)

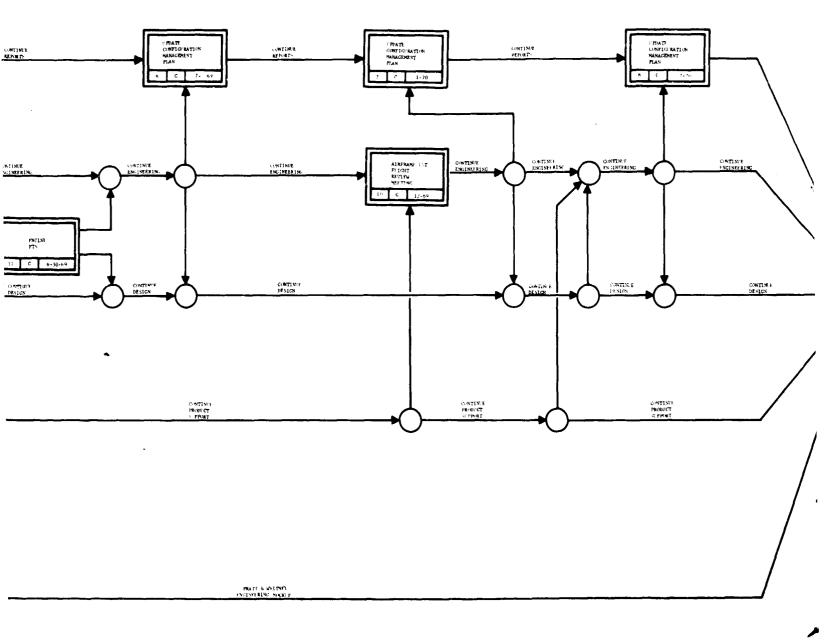
Figure 10. 2.06 Configuration Management



2.06 Configuration Management

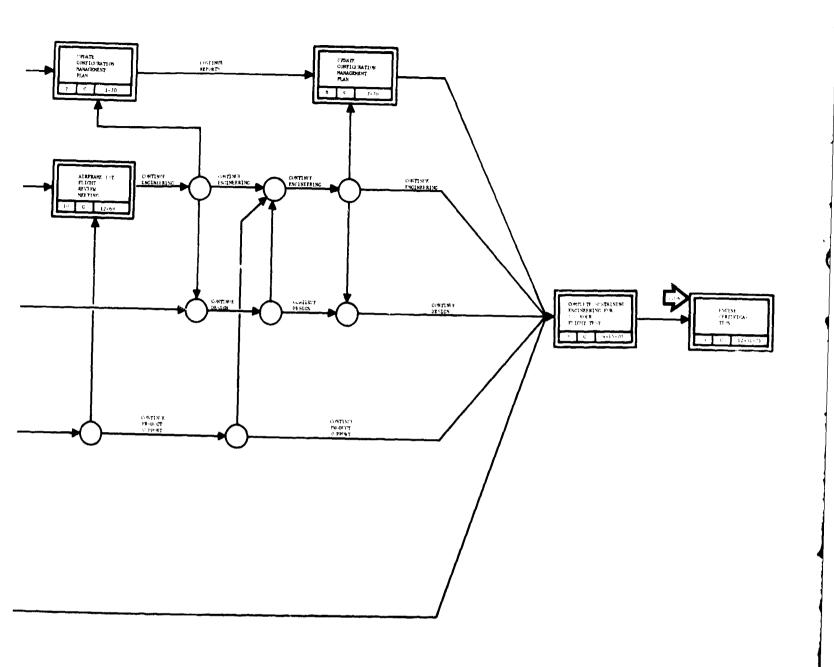


					CTIONARY
Description and Culteria	Event Number	Description and tratects	Frent Number	Description and crateria	
START PMASE III. Start III wordead received III. Start of Phase III. Phase III wordered received III.	h	DPDATE CONFIGURATION MANAGEMENT PLAN Make the pasty obtained to conffiguration Management Flan to whom actual minutums accomplished. Submit	10	ATRIBANE INT FRIGHT REVIEW MRETTHS, conduct Times for the sections	Rvent Humber 15
"PDATE CONFIGMATICS MANAGEMENT PLAN		terrard plan.		Manufact over from between thought reviews	
Make the easily ferilations to Centigestation Management Flow to show actual astronomics accomplished. Include condits of Tutagel textee of engists design. Submit tex and plan.	7	OPDATE CONFIGURATION MANAGEMENT PLAN With necessary sectorisms to Configuration Management Figure 1, whose solicitude attention to Configuration Administration of	11	abulber 21s Betaturk et grapher berhanna i dan ter, veras tigitina med statetor	
FIGURE CONFIGURATION MANAGEMENT PLAN Historic configuration to Contiguration Management Figure above to train guidadones accomplished to be a recensed (jun)	•	Technologian PRATE CONFICENCIA MANAGEMENT FLAN Make the contacts are taken to Configure toon Management Flan to above cover actively extensive accomplished. Sometiment for the low.	1:	Finance After the of shorten benign conduct from concern of region design costs for exist means and existence. Complete finances on the costs of the	10
CLIAIT CONTINUATION MANAGEMENT PLAN Make increasery of thems to Continuity of them. Flow to show actual nelectors accomplished. Subset concertions	•	CONTING A ADVANCE ENGINE COMPATIBILITY From House outline engine compatibilities for combining facilities condition of distribution engines. Decreated contentions of engine with author		Product at the off recipies making and conduct transitions of the control of the conduct at the	
CEDATE OF METCHARTION MANAGEMENT PLAN Many occupants the capture to conflightation Management Plan for above actual unionity has complished account reclared prior				Retailed over the are a factor from the PES of some the Control of the Control for the Control	4.



	EVENT	marti	MEY	
•.	HONF! I	RA11	WAL BURY	

	Tuest Number	Dankity tych with history (a	Rogers Buggers	Own. Tape cost good Castress	tyen) Baber	Beautiyisim and Epiteria (
- France		CONTINUE CONDITION COLUMN INCOMENTATION OF THE PROPERTY OF THE	1♥	CONTEST MADERNICATION CLASS IS NESTLY (MYSING) Assumbly restrained parts out, descrip modern for contests to talk the descrip, thought on of secolly at Borong	I.	AMBRESTS MEDITED FORTON OF CLASS IS SECTIONALLY. BALES? Assemble viscos is Physicaring the by Comparis resembly
P. Carlos	, t	eles (eg.med.	20	DELEVER Meny channe (f. Men at r. care the r. n may live measure for it house new Bouring cone at more pay the bloom managing for Morning	15	PRINTER BRIGHT CLASS \$11 MERCHIF CLASSESP - depends of comment (lass like incomment makes) by a second class the incomment makes. The comment of comment is the comment of
Vicinity Paris		CONTINUE CONDITIONING OF ENGINE INVESTIGES AND A THREE TO THE CONTINUE OF PROFITE CONTINUES OF THE CONTINUE	н	DELIVER THE REGISTANCE IS HOWER TO CF CONCERNE EMPERATOR COMMITTEE TO THE COMMITTEE CONCERNED TO THE COMMITTEE COMMI	3	CHIEFLETS REPRESENTATION OF CLASSE IN RECEIPT (ACCESSES ASSESSED. ASSESSED. CONTRACT TO ACCESSED TO THE ACCESSED ACCESSED TO THE ACCESSED ACCESSED ACCESSED ACCESSED ACCESSED ACCESSED ACCESSED ACCESSED ACCESSED.
• (4)		Filantish deskanten in regionale fit vilketualtus de plassento Entato de dange and comparatolita peaca no fifs Lova protecto o Comparatolita una sento congression	24	compress and class (III builded to things of a second in things of the second in the second s	7	ASSECTION PROST CLARA DES MOCIONES SANCTIONES DE LA COMPANIE DEL COMPANIE DE LA COMPANIE DE LA COMPANIE DEL COMPANIE DE LA COM
Sec Play		Transcott FC6 stand	21	untived ful (Long 17) Wenters (Merima) Complete appendix of memory (Merima) or they (if	.•	.AMPRIBLE & STATESON FOR NEGATION OF BUY MET BY AT TRACE
	.•	sintage time independents and fire course in datable day independent Birli Cirki in agenteral despise independentaria. Day 1788		declare to diverse,		# For of Physic \$43. Separation in more for got testing.
		contiguation to require to epicational congruents design anti-tra-contiguention			24	emismo vadsteligastia Belesema vagino no ni 6,50 fee degresystim yni veitesta



	Desputing to produce a service of a	24 cmt Sante.	Degratyti w gast catego.a
.•	COMPTRES MOMERAL ACTION CASE IS MERCIP COMPTRES ARRESTS CHESTO AND LINEAR LINE BOARDS MOVED COM- TRES TO A CONTRES IS MOVED OF A MERCIPAL ACTION ARRESTS AND ARRESTS ARRESTS ARRESTS AND ARRESTS AND ARRESTS ARRESTS AND ARRESTS ARRESTS AND ARRESTS ARRESTS AND ARRESTS ARRESTS ARRESTS AND ARRESTS ARRESTS ARRESTS ARRESTS AND ARRESTS ARRES	<i>i</i> •	LIMPLETS INVOCATION OF CLASS IT STATUTESCH. Novally Association (Trac II) the lawering modern of sociation appears
•	WELL-THE NEW - LABS 12 MAY MET - 1,4 to - organise - debendage - force - one flowing stylese LE - on the continue model y for flowing	\$:	Milita delle (Les III) del di la la della
• •	DASCOVER COM THE LANS OF MENTERS OF MENTERS AND	î.	implate distinguishment of cases it doesn't because of cases, in the same of t
**	destruct that there is superior the second of the second o	¢.	Micres stast chast \$1 Magner (Locality Seconds Corn tombooks sides 118 modes) - Decrees Cotal Localities (a) in the books
	addited (Montage ()) maken to appropri (Monte seminor) to disc about the share ()) modify to dealing	e♥	amplete water etc. enciments. One per apen etc. etc. etc. etc. etc. etc. etc. etc.
		:•	BACTOR LEGITICS GREENS IN THE CO. M. ST. AND CO. M.

PWA FP 66-100 Volume V

2.07 SAFETY

The JTF17 engine Safety Plan presents Pratt & Whitney Aircraft's approach to assuring engine safety, and includes an Operational Safety Analysis of the engine installation. The safety plan establishes safety considerations during engine design and development in order to assure maximum safety during airframe/engine integration and operation of the Supersonic Transport. Details of this plan are described in Volume IV, Report C.

The primary objective of the Engine Safety Plan is the assurance of maximum safety consistent with other engineering parameters throughout the design, development, production, and service phases of the engine development program.

The philosophy used to ensure engine safety is to design safety into the engine so that operational hazards are at an absolute minimum. The safety program will require the preparation of Failure Mode and Effects Analyses (FMEA) which are an outgrowth of the Reliability Failure Mode and Effects Analyses, periodic design reviews for safety and trade-off studies against weight, performance, human engineering and reliability. This program also requires constant surveillance of the installed system to assure that safety aspects have been coordinated with the airframe manufacturer.

FAILURE MODE AND EFFECT ANALYSES

Hazardous failure modes and their effects will be identified, evaluated, and classified for all engine subassemblies. The design criteria will be reviewed and redesign will be accomplished to eliminate any failure mode classified as catastrophic. This effort will utilize data developed in conjunction with the Reliability Program.

All critical or catastrophic hazardous effects identified by this analysis will be corrected or reduced to a lower classification and reported in semi-annual reports.

DESIGN REVIEWS

The detailed subassembly and assembly design layouts will be reviewed from the overall engine safety point of view and reported. These design reviews will assure that the design criteria have been incorporated and that design weaknesses will be identified. Service information from current engines will be used to pinpoint the particular areas that have caused safety problems in the past. Particular attention will then be brought to bear on those areas to assure that design experience and improvements will be incorporated to reduce the probability of the occurrence of similar incidents. Any safety hazard uncovered by these reviews will immediately be brought to the attention of the Program Safety Engineer, the Project Engineers, the Chief Design Engineer, and the pertinent designers. Followup by the Program Safety Engineer will continue until the identified hazard is resolved.

PWA FP 66-100 Volume V

Trade-off studies will be made throughout the program to determine the effect of safety considerations on reliability, weight performance and maintainability. These trade-off studies will be documented, summarized and reports submitted during the program.

The major milestones, network chart and event dictionary for the safety program are shown in figures 11 and 12, respectively. Test planning and integration of safety is presented in Test, Volume IV, Report E.

Pratt & Whitney Aircraft PWA FP 66-100 Volume V

FD 17886 VH

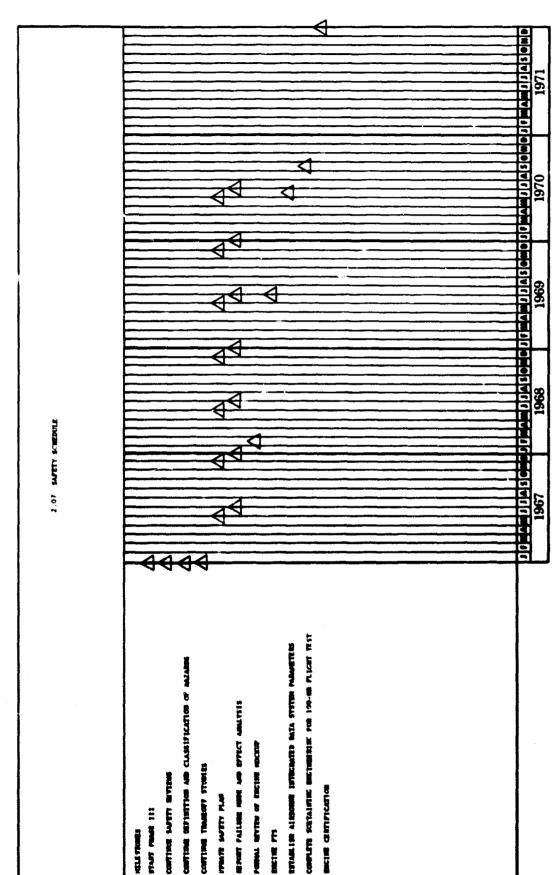
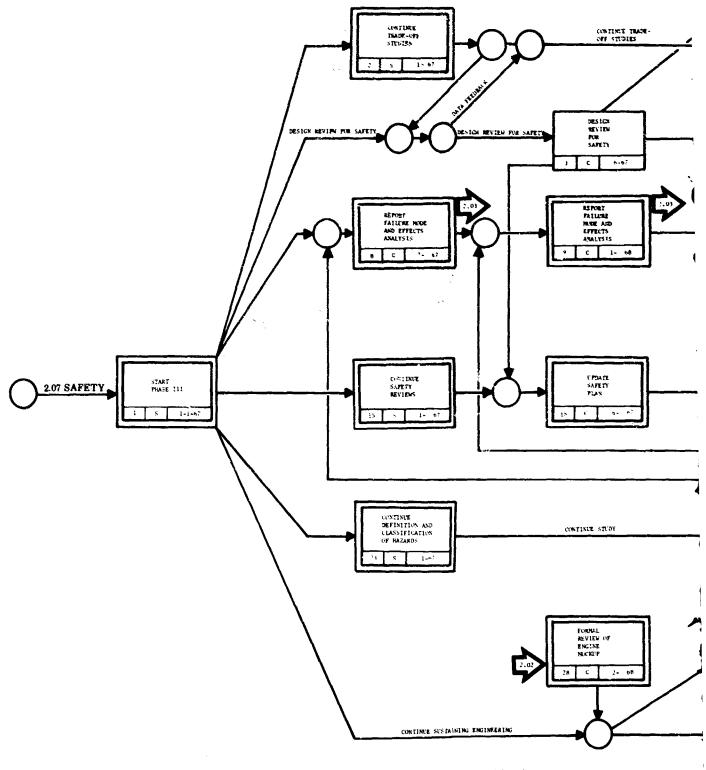
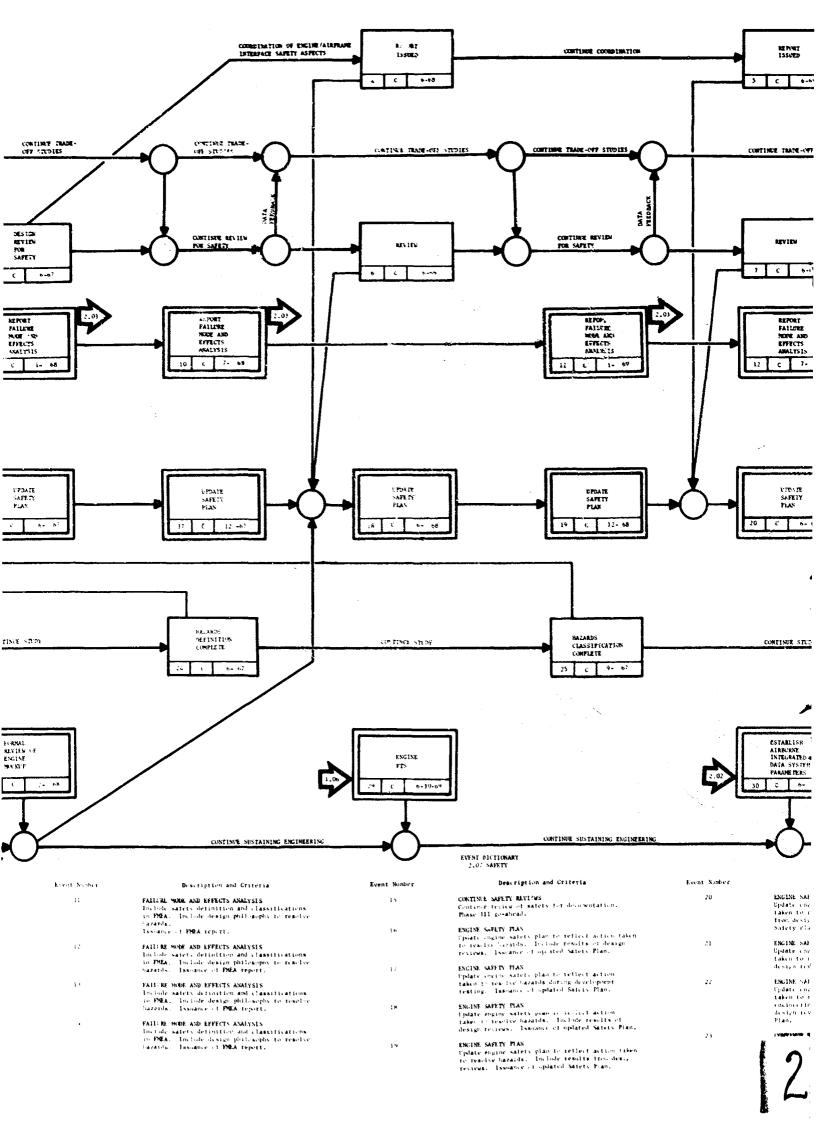


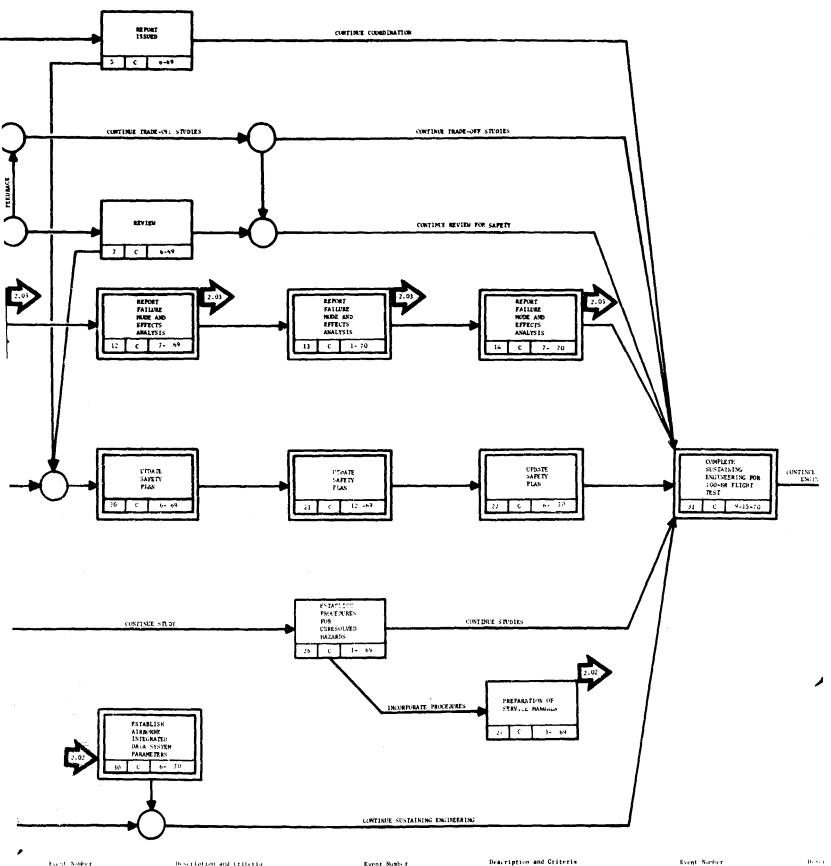
Figure 11. 2.07 Safety



Ecetel Number	Description and Criteria	Event somher	Description and Criteria	Event Number
i	START PHASE 111 Start of Phase 111. Phase 111 goraheat received from FAA.	6	DESIGN REVIEW FOR SAFETY Review of all layouts for majery. Approval and issuance of layout.	П
Ų.	CONTINUE TRADE-OFF SIGDLES Continue design st dies of factors afterling safety and the trade- if effects on other engine parameters.	7	Design Review FOR SAFETY Review of all Javosts for malety, Approval and insurance of layout.	15
i	DESIGN REVIEW FOR MAPFIY Review of all layouts for matery. Approval and issuance of layout.	н	PAILIER MODE AND EFFECTS ANALYSIS Include maters definition and classifications in PMEA. Include design philosophy to resolve hazards. Issuence of PMEA report.	13
•	COMMINATION OF AIRFRAIZ 75%C INTERPACE SAFETY Busing that safety considerations have been satisfied by major of 1001 Servey Lavours. Approval and pricase of Levours.	ų	FAILURE MUDE AND EFFECTS ANALYSIS Include matery of function and classifications in FMED. Include design philosophy to resolve hazards.	4.5
5	COUNDINATION OF AIRPRAGE ENVISE INTERPACE SAPETY Process that safety considerations have been satisfied by case of Field Solvey Lavours. Approval and release of lavours.	In	Isocance of PBA report. FAILURE HODE AND EFFECTS ANALYSIS Include safety definition and classifications in PBEA. Include design philosophy to resolve barards. Isocalcy of PBGA report.	

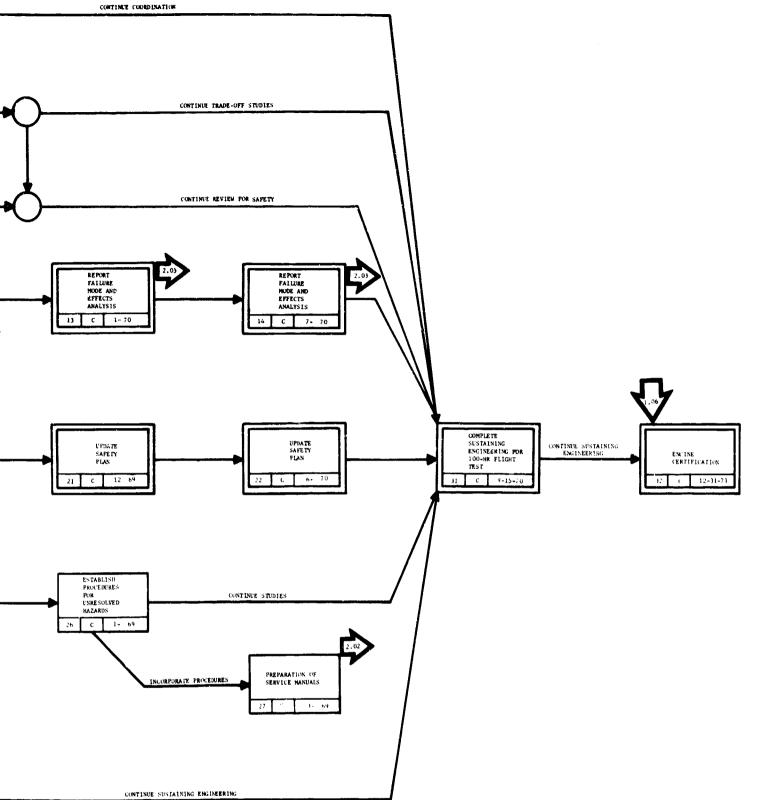
Figure 12. 2.0 Safety





Exect Number	Description and triteria	Event Number	Description and Criteria	Event Number	Descri-
20	ENGINE SAFLTY PLAN Typhate engine safets plan to reflect action taken to resolve hazards. The bale results	2-4	COMPLETE HAZARD DEFINITION compile bazard definition list, locorporate results in FNEA.	29	ENGINE FIS Reference contro and criteria,
	from design reviews. Is-wance of updated Safety Plan.	2 1	CLASSIFICATION OF HAZARDS classify all magards according to critical portions	10	ATRHORNE INTEGRA. Receive and a car :
71	ENGINE SAFLIY PLAN Update copine safety plan to reflect action take to tessive bazards. Include results of		of Hight. Compile list of action taken to resolve varants and include in FMFA.		enticty consider it to arritance cannot
	design reviews. Isolance of updated Safety Plan.	26	PROCEDURE FOR UNRESOLVED HAZARDS Establish procedures to provide safe operation	- 11	COMPLETE SUSTAINA FLIGHT TEST
22	EXCENT SAFFLY PLAN Epidats engine raints plan to reflect action taken to resolve hazards and reprove horam		for unresolved hazards, Compile list of pis is dures for unresolved hazards for incorporation in manuals,		End Place III. (114) ht to time. FNGINE CERTIFICAL
	curlanting features. Tacked results of design reviews. Insumme of updated Solity Plan.	27	PREPARATION OF SERVICE MANUALS Incorporate procedures for unrevolved hazards in Service Manuals and Operating Instructions,	IV.	Relegioner empire and critetia.
2.1	CONTINUE DEFINITION AND CLASSIFICATION OF HAZARDS CONTINUE to compile the hazard definition list.		issuance of revisions to Service Manuals,		
	Centinum to classify #11 hazards added to the definition list according to critical portions of thight.	28	FIGURAL REVIEW OF ENGINE MOUNTY Conduct formal review of Engineering Moukup, An Lusion of review results in Engine Safety Flan.		7





itetia	Event Number	Description and Griteria	Event Number	Description and Criteria
teffect action Lade results of updated	24	COMPLETE HAZARD DIFFINITION opposed to an additional definition. The experience of the transfer of the transfe	29	ENGINE FIS Beta react engine of two kells to the city for and still that
reflect metions	25	LASSIFICATION OF PAZAROS assisted portions of the plant of according to ordered portions of the plant of action taken to involve bazards and include in PMPA.	4(;)	AIRMANNE INTEGRATED DATA SYSTEM Rective and establish and epidameter to economically considerations. Side it aids parameter to attitude manufactures.
ende teralte et aplated refets Plan. terlect action Poptove namm	.46	PROCEDURE FOR UNRESOLVED HAZARMS Stablish procedures to provide sate speciation for antisolved hazards, compile I; t of proce- dures for unresolved bizards for fixey poration in nameals.	11	CIMILETE SUSTAINING ENGINEERING FOR 125 - HOUR FELICAL TEST EAST PLANS THE 5 - Appletion of 195 hours of Hight testing.
tesults of appleted Solity	:1	REPARATION OF SERVICE MANUALS. Incorporate procedures for unrevolved hazards in service Manuals and operating instructions.	M	ENGINE CERTIFICATION Reference engine network 1,00 for in scription and criteria.
IFICATION OF HAZARDS d definition list.		casuance of resisions to Service Manuals,		
ide added to the cillical portions	≯ B	FORMAL REVIEW OF ENGINE MORKEY Conduct formal review of Engineering Morkup, an Inspen of review results in Engine Safety Flam.		

PWA FP 66-100 Volume V

2.08 TEST PLANNING AND INTEGRATION

Careful integration of the engine and component test programs is provided to assure that the JTF17 engine development program will proceed in the most expeditious manner to achieve the required engine performance and maturity.

The Project Group directs the test integration program. Experimental engineers from this group define each test to be conducted, determine the instrumentation required and its accuracy, and personally direct each test. Integration of test results is a continuous process through the interrelation of Assistant Project Engineers and Project Engineers within the Project Group, each upward level of technical direction having a wider sphere of responsibility over the detail parts, components, subassemblies, and assemblies which in total make up the engine.

The test integration process begins with the release of an initial design to Manufacturing by means of an Experimental Release from Design by Project Engineering. Following the completion of manufacturing, the parts are delivered to Assembly by means of parts requisitions, and the assembly instructions are provided by experimental engineer's memoranda. The assembled engine or components are delivered to test together with instructions for installation on the test stand, including instrumentation requirements. Specific test instructions and test programs are provided by experimental engineer's memoranda.

All engine and component testing requires data recording with most engine and major component tests utilizing automatic data acquisition. Automatic data printout sheets and test stand log sheets are transmitted to the Performance Group for performance analysis. The results of the performance analysis are presented to Project Engineering for use in continued program planning. Minor component test data may bypass this portion of the flowpath with the test data transmitted directly to Project Engineering. These data are analyzed by the Project Group to determine if performance or mechanical deficiencies exist. If a deficiency exists, a comprehensive failure analysis is conducted to determine corrective action. This analysis is conducted by members of the Project Group, Performance, Reliability and Safety, Design, and Materials Laboratory. Corrective action for the deficiency is then coordinated by Project Engineering with Design, and design changes are requested by memoranda. When completed, these changes are approved by Project Engineering prior to release for experimental parts manufacture.

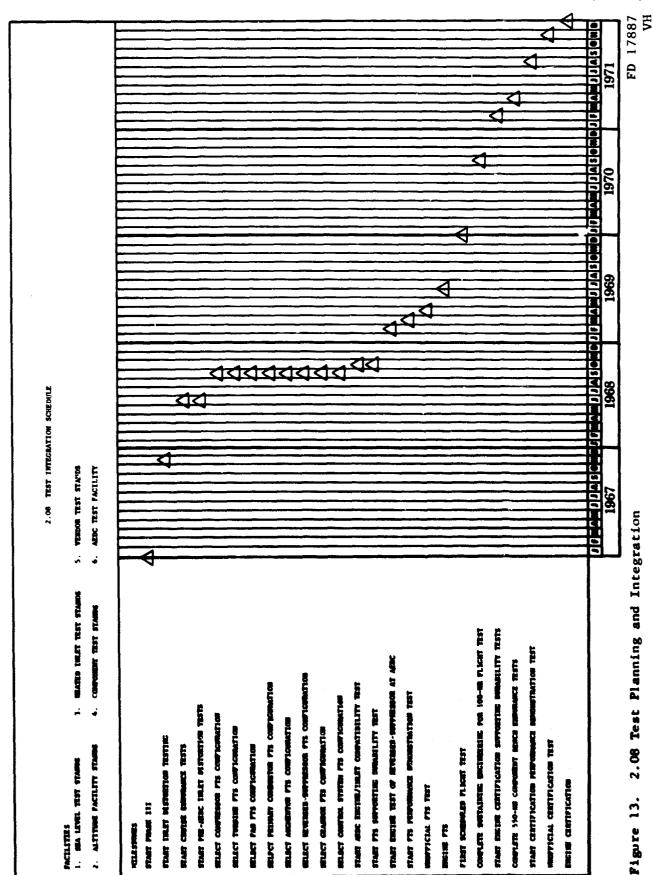
Statistical methods will be applied during the pretest planning to assist in the test integration. Component and engine test programs are devised to obtain the maximum relevant information from each test by (1) proper design of experiments, (2) analysis of instrumentation precision and accuracy, (3) statistical data analysis, and (4) the measurement of the uncertainty associated with the estimates and conclusions based on experimental data. Statistical methods will also be used in optimizing computer data reduction programs, determining instrumentation requirements and calibration methods, and in the analysis of reliability data.

PWA FP 66-100 Volume V

The major milestones and test integration chart for the test planning and integration program are shown in figure 13 and figure 3 of Volume IV, Report E.

A detailed description of test planning and integration is presented in Test, Volume IV, Report E.

PWA FP 66-100 Volume V



(

Figure 13. 2.08 Test Planning and Integration

•

PWA FP 66-100 Volume V

2.09 DATA MANAGEMENT

The Data Management Plan describes the program which Pratt & Whitney Aircraft will implement to generate, collect, store, and distribute significant technical, financial, and managerial data. These data will be used to facilitate program monitoring and decision making, promote economy, expedite coordination, and inform the FAA, airframe contractor, and the airlines.

Included in the Data Management Plan, Volume V, Report D, are the data management group organization and functional responsibilities, and the Data Requirement Document, which describes the data that will be generated in the development program. Table 1 presents a Data List and submission schedule.

Pratt & Whitney Aircraft
PWA FP 66-100
Volume V

Table 1. Data List

Item	Title	Submittal Date	Frequency
1	Progress Report	March 1967	2 Months
2	Data Management Plan Update	May 1967	6 Months
3	Data Accession List	March 1967	2 Months
4	Data Requirements Document Update	May 1967	6 Months
5	Configuration Management Plan Update	July 1967	6 Months
6	Model and Performance Specifications Preliminary Firm	July 1967 Prior to Phase	6 Months III Completion
7	Engineering Change Proposal	As required	
8	Configuration Inspection and Review Plan	July 1967	6 Months
9	Cost Status Report	February 1967	Monthly
10	Schedule Status Report	February 1967	Monthly
11	Detail Work Plan Update	February 1967	Update as required
12	Cost Baseline Report	September 1967	Annual
13	Cost Control System Update	February 1967	Update as required
14	Schedule Control System Update	February 1967	Update as required
15	Control Room Data	As required	
16	Subcontract Plan Update	April 1967	Update as required
17	Value Engineering Program Update	June 1967	6 Months
18	Annual Report	January 1968	Annual
19	Final Report	Phase III Conc	lusion
20	Data Central File	Merch 1967	2 Months
21	Maintainability Program Update	August 1967	6 Months
22	Airline Maintenance Plan	December 1969	
23	Systems Safety Plan Update	June 1967	6 Months
24	Product Support Program Including Training and Training Equipment Program Update	July 1967	6 Months
25	Reliability Program Update	July 1967	6 Nonths
26	Quality Assurance Program Update	August 1967	6 Months

Pratt & Whitney Aircraft PWA FP 66-100 Volume V

Table 1. Data List (Continued)

Item	Title	Submittal Frequency Date
27	Integrated Test Program Update	August 1967 Monthly
28	Facilities ?lan Update	July 1967 As required
29	Master Program Plan Update	June 1967 6 Months
30	High Risk Area Report	February 1967 2 Months
31	Human Engineering Program Update	June 1967 6 Months
32	Follow-on Proposal	Prior to Phase III Completion
33	Flash Failure Report	As generated
34	Subcontractor Acceptance/Qualification Test Report	As generated
35	Engine FTS Test Plan	6 months prior to start of test
36	Final FTS Test Report	30 days after completion
37	Final Report of Inlet/Engine Compatibility Testing	90 days after completion
38	Final Report of Government Facility Testing	30 days after receipt of data from Government Facility
39	Final Report of 100-Hour Flight Test	30 days after completion
40	Phases III and IV Detailed Test Plans	July 1967 6 Months
41	Engine Status and Usage Records	February 1967 Monthly
42	Failure and Analysis Report	As generated
43	Engine Installation Manual	July 1967 6 Months
44	Engine Flight Test Report	As generated
45	Manufacturing Program Update	July 1967 6 Months

PWA FP 66-100 Volume V

2.10 PROGRAM MANAGEMENT AND CONTROLS

Pratt & Whitney Aircraft will prepare and maintain key plans to implement the management and controls required to ensure successful and timely completion of the JTF17 engine development and flight test programs. The following plans are included in the total management effort and will be used to promote economy, facilitate decisions and program monitoring, expedite coordination and provide information to the FAA, airframe contractor and the airlines:

Plan	Proposal Location
Cost and Schedule Control Plan	Volume V, Report F
Subcontract Plan	Volume V, Report E
Master Program Plan	Volume V, Report A
Program Review Plan	Volume V, Report A
Detail Work Plan	Volume V, Report H

2.11 FACILITIES PLAN

Agreed residential and addressed a Machinera made sugarior of the contract of the contract of

For the performance of the Supersonic Transport Engine Development Program through Phase III, Pratt & Whitney Aircraft will make available, if required, the existing supersonic engine development facilities at the Florida Research and Development Center, and at the main plant in Connecticut. Additional capital facilities required for the performance of Phase III of the engine development program will also be furnished together with the additional capital facilities required for the manufacture of ground and flight test engines. The use of Government facilities will be required during the development program for engine-inlet system compatibility testing and engine reverser-suppressor performance testing described in Volume III, Report D, Section III, and Volume III, Report E, Section III, respectively.

The following modifications or additions are planned for the JTF17 engine sea level and altitude test stands, component test stands, and manufacturing equipment and space:

SEA LEVEL TEST STANDS

- 1. Modify test stand A-5 to accommodate the JTF17 engine
- 2. Build a new reverser test stand, A-9
- 3. Modify two sea level engine stands, A-6 and A-7, for prototype and overhaul engine test
- 4. Install additional fuel supply tanks and fuel distribution system, extend the data acquisition system, and add a starter air supply system to the sea level test area.

ALTITUDE TEST STANDS

- 1. Modify high Mach number test stand C-4 to add full Mach number range and airflow capability
- 2. Build an additional test stand C-6 with full Mach number range and airflow capability
- Build a new test stand C-7 with the capability of testing engine full-scale fan and high compressors using heated inlet air
- 4. Provide increased sirflow capacity in the high Mach laboratories by installing additional compressors, exhausters, heaters, air scrubbers and the related drives, dusting and valves
- 5. Hodity test stand X-210 (Willgoos Laboratory) to provide refrigeration capabilities for low temperature operating conditions.

PWA FP 66-100 Volume V

HEATED INLET TEST STANDS

- Build a new test stand, C-8, to provide rammed heated inlet and altitude exhaust capability
- 2. Build a new test stand, C-9, to provide rammed heated inlet and altitude exhaust capability
- 3. Build a new test stand, C-10, to provide rammed heated inlet and altitude exhaust capability.

COMPONENT TEST STANDS

- 1. Modify test bench D-7 to provide increased air supply, air heater, revised drive and mounts
- 2. Modify test bench D-10 to provide increased air supply
- 3. Modify test bench D-11 to provide increased air, fuel and electrical systems
- 4. Modify test bench D-12 to provide increased air, fuel and electrical systems
- 5. Modify test bench D-16 to provide increased fuel system
- Modify test bench D-18 to provide increased air, fuel, drive and electrical systems
- 7. Modify test bench D-24 to provide increased air and drive capabilities
- 8. Modify test benches for ignition systems to provide increased electrical and temperature capabilities
- 9. Build two new electronic fuel control test benches
- 10. Build new fuel control, hydraulic pump and fuel nozzle flow benches for prototype and overhaul program.

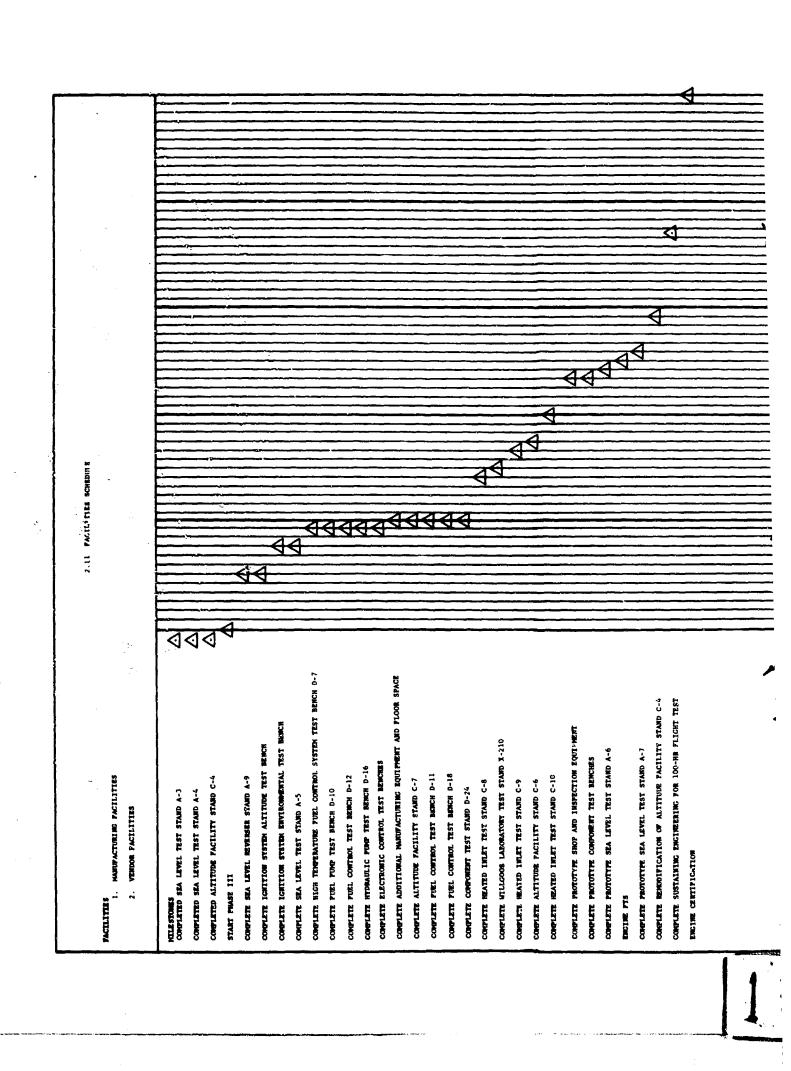
ij

MANUFACTURING

- The necessary manufacturing and inspection tools and equipment will be provided
- 2. An additional 96,000 square feet of floor space will be constructed.

The major milestones, network charts and event dictionaries for the facilities are shown in figures 14 and 15, respectively.

A complete and detailed Facilities Pian is presented in Volume V, Report B. Test planning and integration of facilities is presented in Test, Volume IV, Report E.



PWA FP 66-100 Volume V

FD 17888

> COMPLETE MEMODIFICATION OF ALTITUDE PACILITY STAND C-4 COMPLETE SUSTAINING ENGINEERING FOR 100-HR FLIGHT TEST

DECINE OF STIFICATION

COMPLETE PROTOTYPE SEA LEVEL TEST STAND A-7

COMPLETE PROTOTYPE CONFORENT TEST BENCHES CONFLETE PROTOTYPE SEA LEVEL TEST STAND A-6

CONFIETE PROTOTYPE SHOP AND INSPECTION EQUIPMENT

CONFILIR HEATED INLET TEST STAND C-10

CONFILTE ALTITUDE PACILITY STAND C-6

CONFLETE HEATER INLET TEST STAND C-9

COMPLETE WILLCOOS LABORATORY TEST STAMD X-210

CONFILIT HEALTD INIET TEST STABD C-8

CHETETE FUEL CONTROL TEST BENCH D-18

COMPLETE CONTONENT TEST STAND D-24

COMPLETE ALTITUDE PACILITY STAND C-7 COMPLETE PUEL CONTROL TEST BENCH D-11

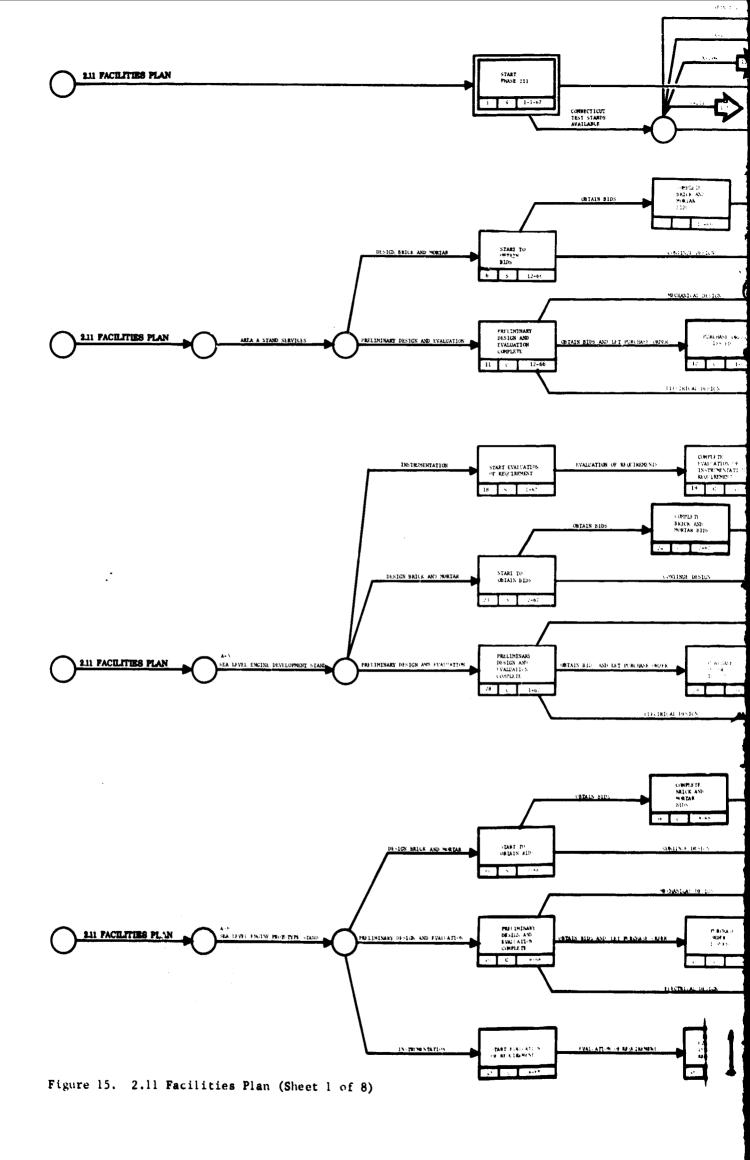
COMPLETE ADDITIONAL HANDFACTURING EQUIPMENT AND FLOOR SPACE

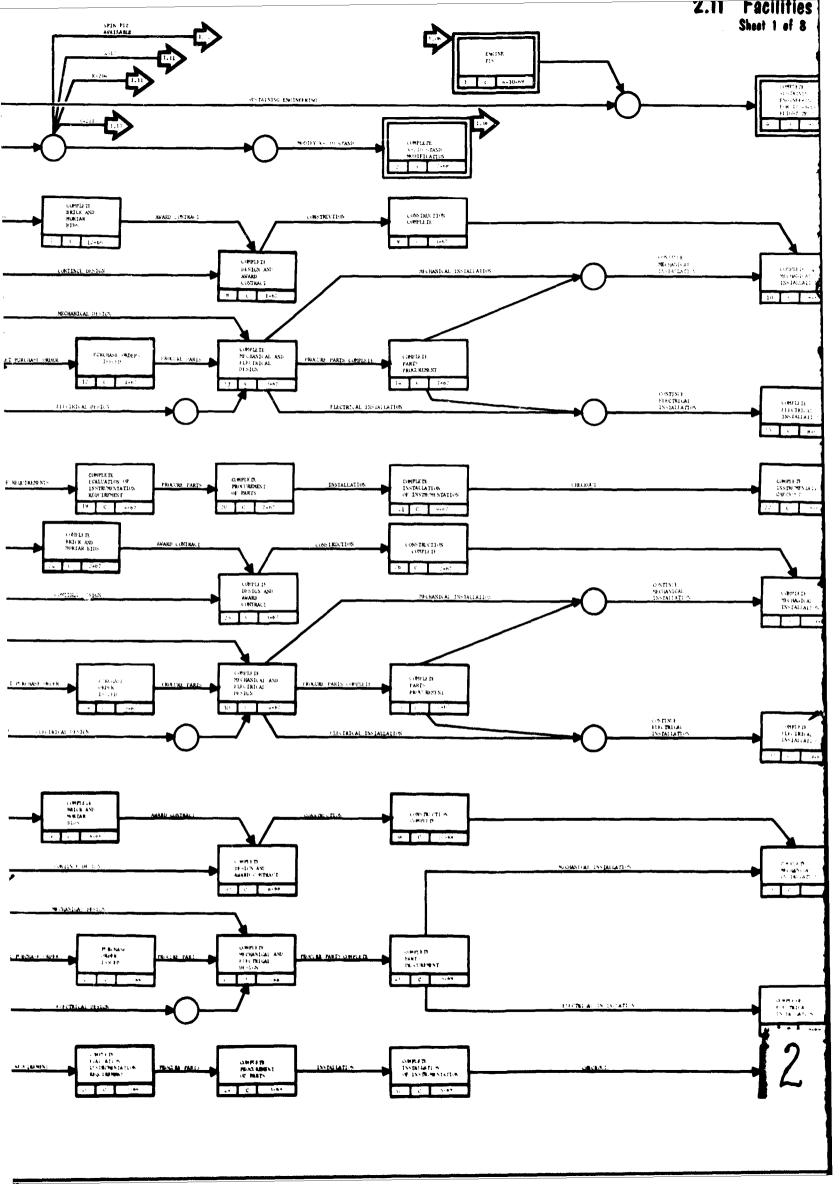
CONFLETE BYDRAULIC FUND TEST BENCH D-16 CONFLETE ELECTRORIC CONTROL TEST RENGRES

חשובושוב נחבר החשונה יבשו שפשינו הביד

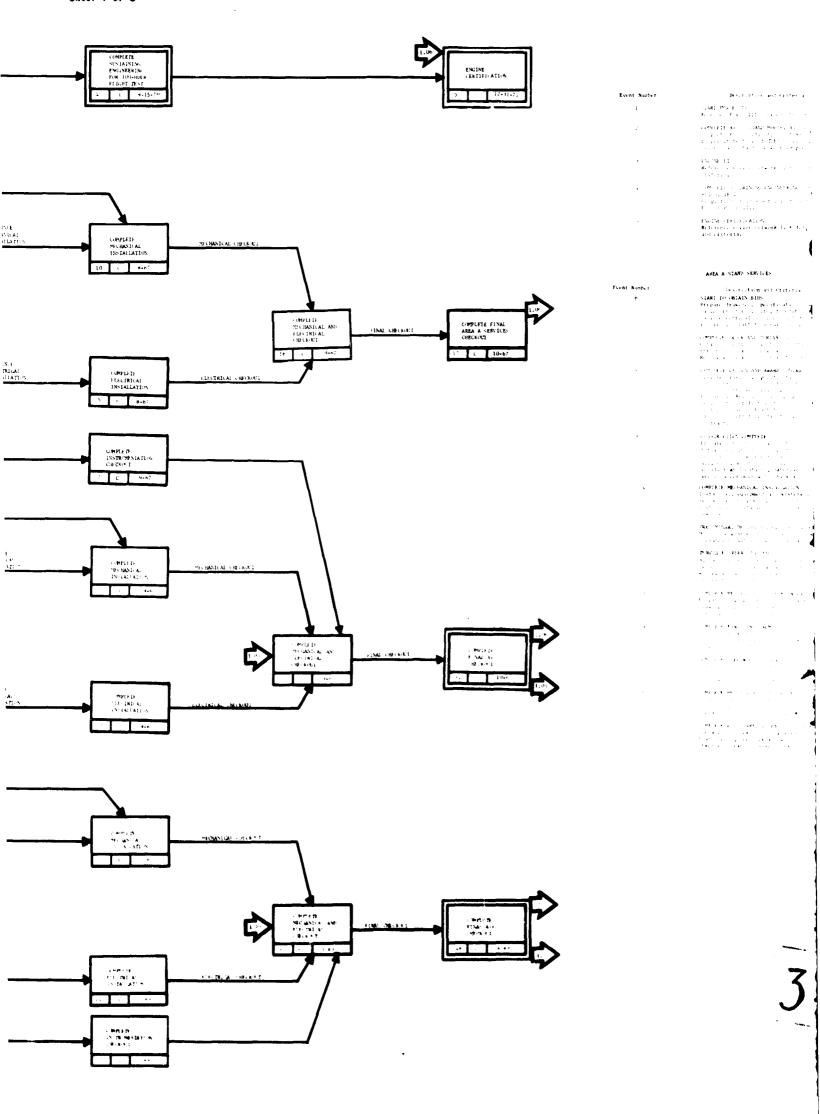
Figure 14. 2.11 Facilities Plan

,





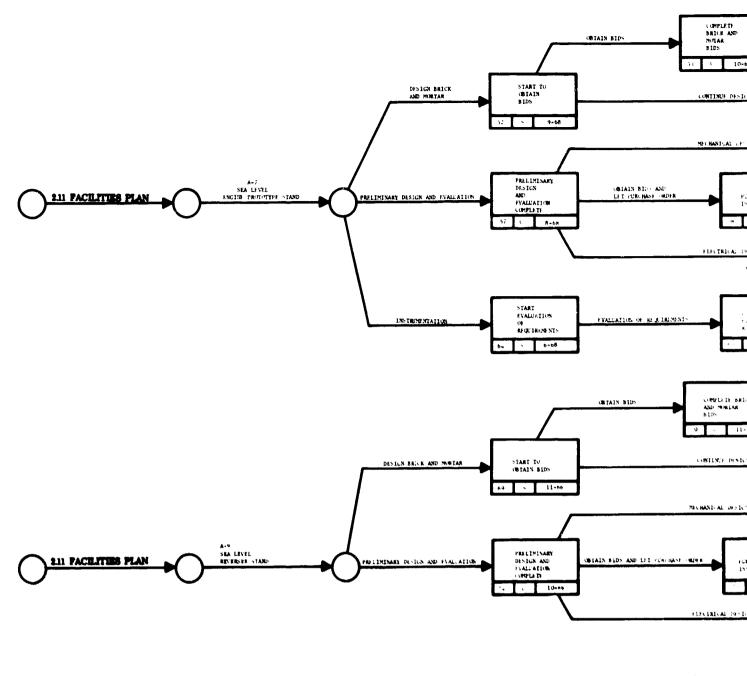
2.11 Facilities Plan Shoot 1 of 8



A- - SEA LEVEL ENGINE DEVOLOPMENT STAND

A-6 SEA LEVEL ENGINE PROTOTYPE STAND

	Frest Names	_		NAME OF THE PROPERTY OF THE PR
Description and troteria	First Name and	Personaprison out stateman	Even! Number	Description with a temps
mod Book (1) Karama Para Marama (1) (1)	. e	GARE EVALUATION OF BEGINDMENT For in the work looking of delices on appearing to confed and looking are two for most operations conditions.	1:	Links D. (BEACH 2016) Property of stagged signs of control which control in the hard- soften Europe, Cotton of Cathories in Control Page 2016 Control Control Control Control of Control Control Control Control (1997).
 Modela Annia - Gamerica Gallos Application of the control of the cont	. 0	COMPLETE STATEMENTS OF INSTRUMENTATION REQUIREMENT Notice of the instrument at the equipment of the completion of the c		mantem, from the factor and the set from a first set from a first set from the set
		to an exportant for existing objects	4,	4. 9時1名河 治泉() A. AND MIMITAN (F.17)。 4世末4日 - 1.15年 世 アンメージセラー・フィルフィル・ファー History エ
AND THE EDITOR OF THE RESIDENCE OF SEPTEMBER 1997 AND THE SECTION OF THE SECTION		- MITE (F. TROKET REMOTE OF FARE - RECORD OF Particles of the residence of Record parts		Office that the property of the form of the form of the property of the form
More and the control of the control		 project of project to the Macades and a section fields and control of the project of the section of the project o		From the first than the second of the secon
etaria de la composition della		GENERAL IN ENTERTION OF INSIREMENTATION		And the second s
en jih ere. 1920 A. Moderne e. 1930 - Other M. J. A. Teach Graphian Graphian		 In the control of the part of		Experience of Action Conference of Conferenc
		* ***		and the state of t
		Description of the Process of the Board of the second o	18	CORNEL CLOSE OPPOSED AND THE CONTROL OF T
AREA A STAND SEPS INES				and the state of t
Secretaria manda miteria		TABLE DESIGNATION OF SERVICES AND		A Company of the Comp
START OF OBJAIN ADMI TEXPTOR TOWARD CORPORATION OF A CORPORATION		the contest of the water of the contest of the cont		Specific Medical School Action
PPCT		A second of the		
		CHARLES BY RELEASING WHILE THE		en de la companya de La companya de la co
Hermony Control of the Burker of the Control of the		The state of the s	**	d Meri MyNorde Herrich (1997)
en and a little for the second of the second				the second secon
the first of the control of the Address of the Addr		 Brown the consequence of the first of the consequence of the first of the consequence of the first of the consequence of the conseque		A section of the sect
And the second s		The first product of the control of		A CAMPAGNA C
		en de la companya de La companya de la co		and the second s
		and the second of the second o	•	Service South Service (Service Service
STATE OF STA				
 State (Market State (Market Sta		and the same of th		Milly to the protect of Mariana and Committee of the Comm
The second secon		process with the control of the cont		 Both Control of the State of t
(i) A contract of the contract of the property of the prope			••	COMPUBLIE BUBLISH CA CANCEND AND CO
SMELEDE MESONAL INSTAURAÇEN. Total instauration in the control of		Control of the Contro		
		4 · *		, which will be a second of the second of th
NEW OR STATE	•	One of the second of the secon		
Andrew Communication (Communication Communication Communic		two days are with the		Company of the second of the
Park Administration		• • • • • • • • • • • • • • • • • • •		The second secon
				Marine Communication (Communication Communication Communic
		e programme some some	•	And the second s
		A contract of the contract of		
			.*	we will be a second of the sec
		Mary North State (Astronomy)		•
Section 1. The second section is a second section of the second section in the second section is a second section of the second section in the second section is a second section of the second section in the second section is a second section of the second section of the second section is a second section of the second section of the second section is a second section of the sec		•		Section 1.
		Complete Company		
e e e				• , •
		$(x_i, y_i) \in \mathbb{R}^{n \times n} \times \mathbb{R}^{n \times n \times n \times n} \times \mathbb{R}^{n \times n \times n \times n} \times \mathbb{R}^{n \times n \times n \times n \times n} \times \mathbb{R}^{n \times n \times n \times n \times n \times n} \times \mathbb{R}^{n \times n \times n} \times \mathbb{R}^{n \times n \times$		
g (4) +3				
				PHILE TO THE STATE OF THE STATE
		1.00		



Freist Bumber

4+2 NA SES

Spanish to the president test car

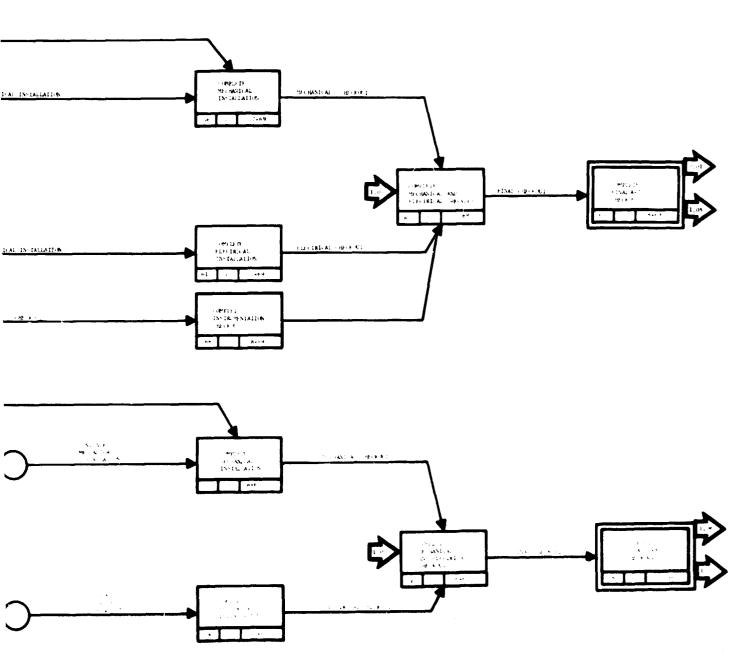
Program analysis produced to the many three services and the services of the s

The state of the s

Company of the compan

Here is the major and the control of the control of

Sheet 2 of 8 51 (10-68 € 12-68 COMPLETE DESIGN AND AWARD CONTRACT CONTINUE DESIGN Su C 10-44 COMPLETS PARTS PROCUREMENT COMPLETE MECHANICAL AND FLECTRICAL DENIGN PRINCIPE PARTS FLECTRICAL DESIGN LICTRICAL INSTALLACION COMPLETE PROLUREMENT OF PARTS COMPLETE INSTALLATION OF INSTALLATION CONSTRUCTION COMPLETE CONFLETE DESIGN AND AMARD CONTRACE The second secon



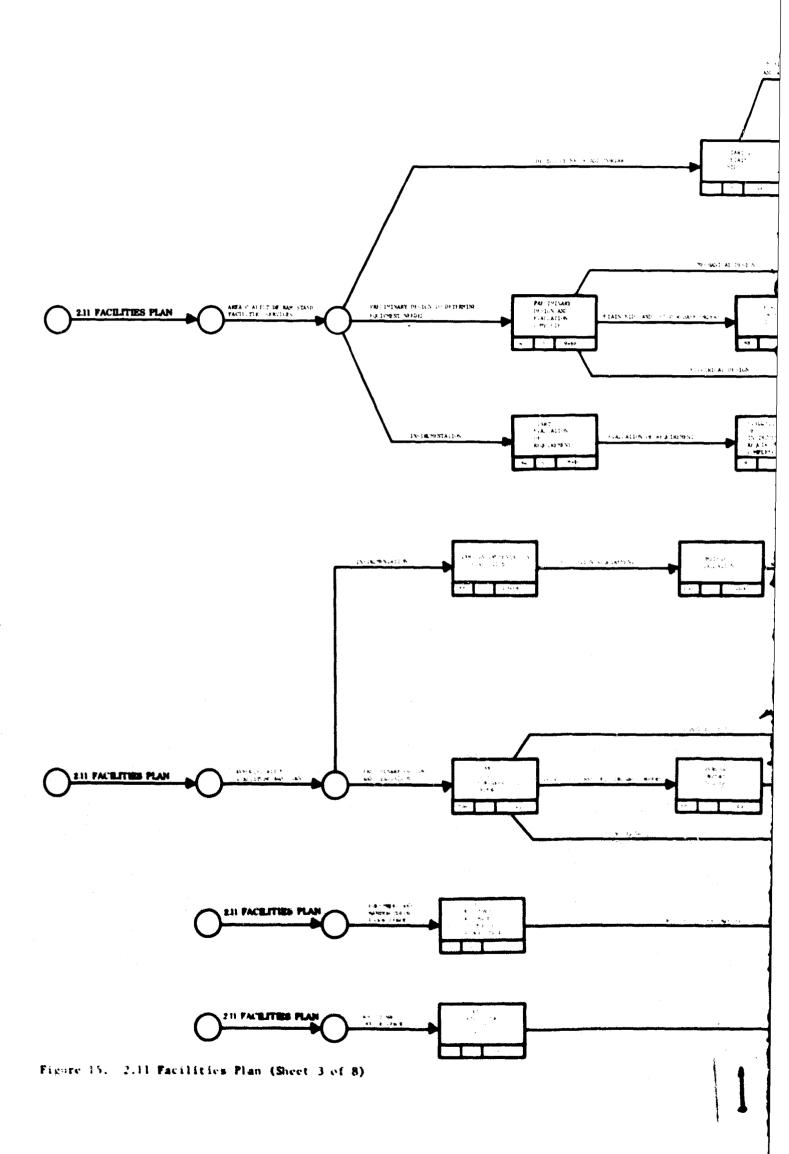
and the second second

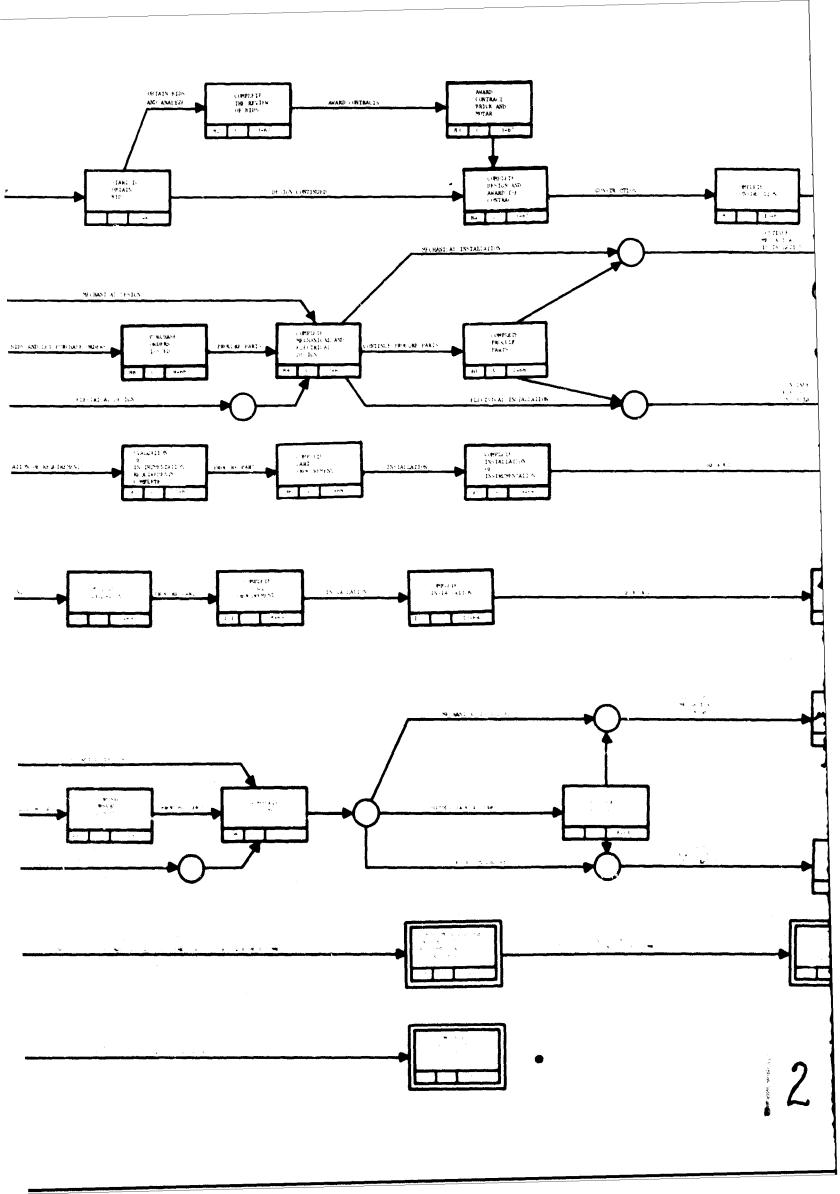
A second of the s

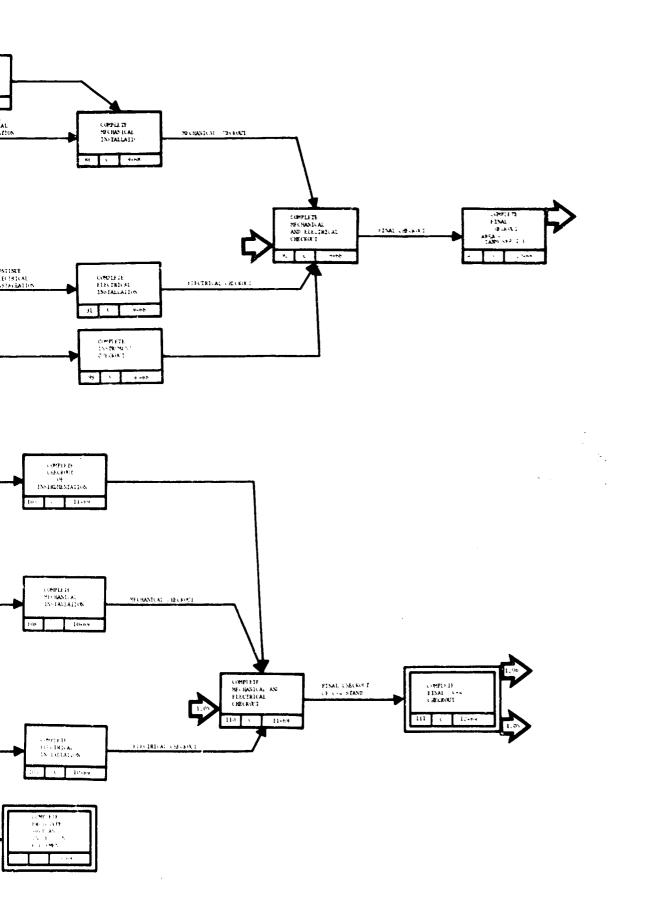
no na kirika ana na na manaka ana na man Na manaka ana na manaka an

West of the second of the seco

3





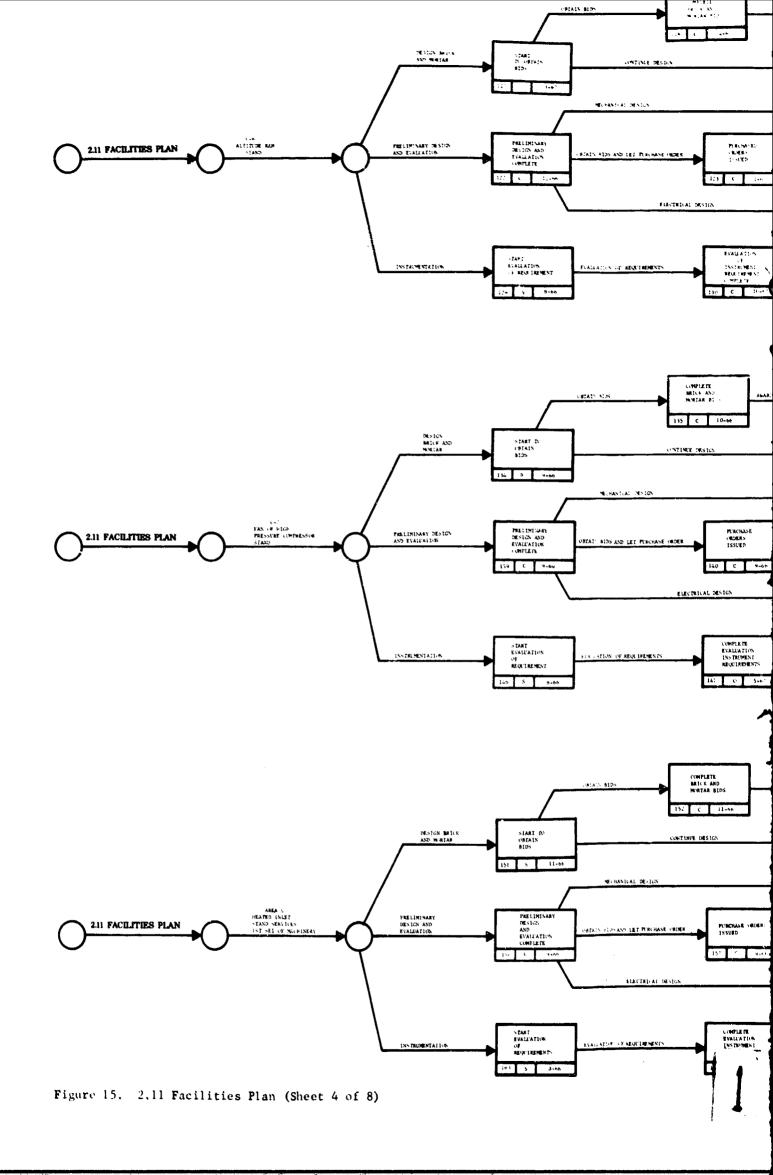


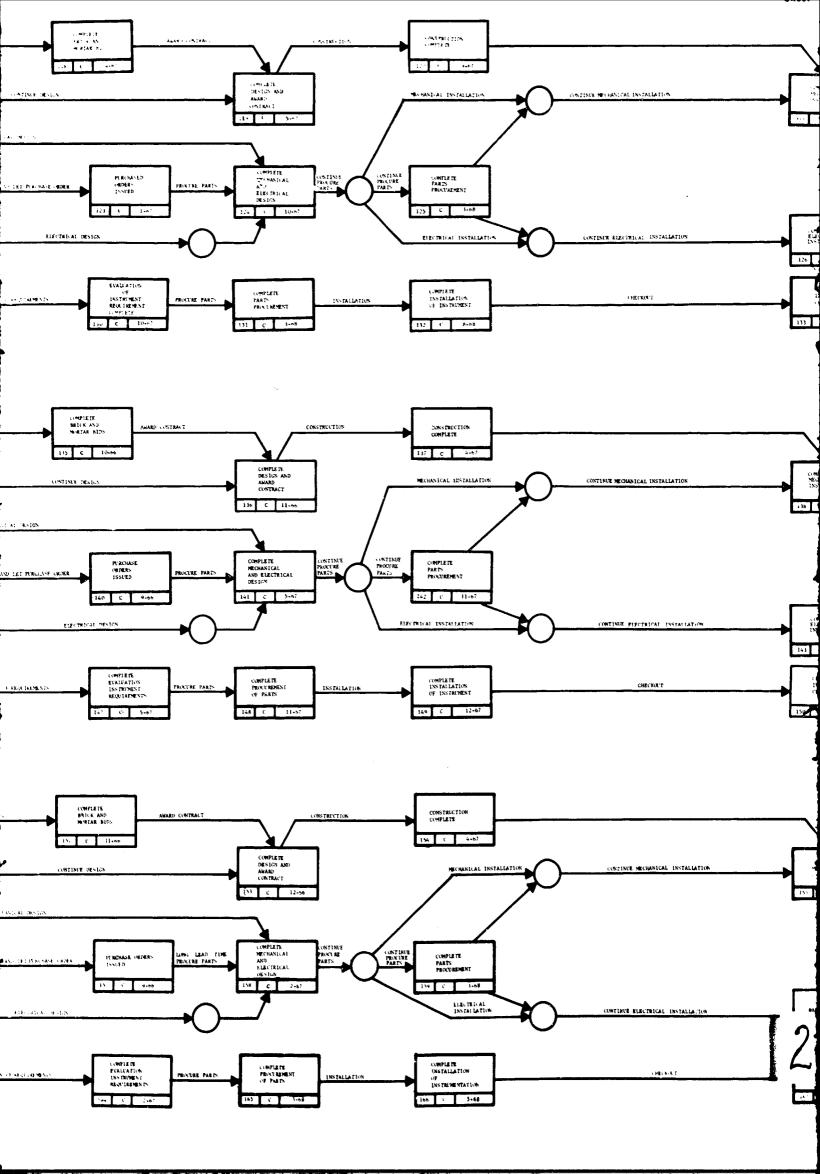
		famoth wat, he are actived		
AREA	AUTITITE NAME STONE FACILITIES STEETES	1.4 - 5.4 - 44		
Kinns Nazer	www.nintu.co.asco.cutativa		Tage 1 to 1 t	
•	CLART TO PRINCE NO. S. Promotion of the Control of		ng en grand de de la companya de la La companya de la co	
			• • • • • • • • • • • • • • • • • • • •	
	 A property of the control of the contr			
	A CONTRACTOR OF THE CONTRACTOR			
	10 - 10 - 10 - 10 - 10 - 10 - 10 - 10 -		444 Te 0 10 44 17	
	with the death of the		Mary Admirate Control	
•.				
	Complete that the control of the con			
			. • • •	
•	AAAD CONTRACT POR TRUCK SCOTT WARD TO SEE A STATE OF THE SECOND S		1 mg y 2 (2) 2 / 2/2	
	Service of the Servic			
٠.	Compage (Color) of the Color Analysis of the			
			* *	
	windows and reserve and the second of the se		** * t	
	 Application of the second of th			
	 And the second se			
	to your enter the	••	**	
<u>*</u>	COMPLETE OF THE STATE OF THE STATE OF			
	Compage of the contract of the			
	The second secon			
	and the second of the second o			
			v, * + , ,	
•			1.5	
	Company of the Compan			
			A STATE OF THE STA	
		. •	to part of the	
			2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	
	en e		g stamme Harris III kilonik Hilani	
*.	grading the state of the state		organization and the	
*•		,.	فتاؤه والخاصات براكات	
	and the second of the second o			
	[2] A. G. F. F. A. William States of the control		ंक्ष्य ६३ म्ड्रा १३	
			the second of the	
	Company of the second of the s		1. K. S. B. L. C.	
	gravitation and the state of th			
			4, 5, 100 pt 45 c	
	PROBLEM CONTROL CONTROL OF THE CONTR			
	 A control of the control of the first control of the control of the		Competer to Accept	
		•	***	
5-4	CONTROL SANTAN STATE STATE OF CONTROL SANTAN			
	King a King of the state of the		- JAMI FA JE性なった IAM a - かったかまて	
	FRAT ADJUM HE INSTRUMENT OF MELL INSMENDS COMPLETE		811	
	FAMILY AND AN ENGINEER AND			
	separate that require it with the parties of the	•	 94 (2.3) ARMS 8 (2.3) Experience 	
	A STATE OF THE STA		1.464	
	and the state of t			
*	Comparison Annie (Braziliania) (1997) Annie (1997) Annie (Braziliania) (1997) Annie (1997) Annie (Braziliania) (1997) Annie (1	••	Light Fifth Con-	
*	o pitt			
	CALANDER CONTRACTOR OF THE STANDARD			
	Compared to the control of the contr		A 1100 AL 1	

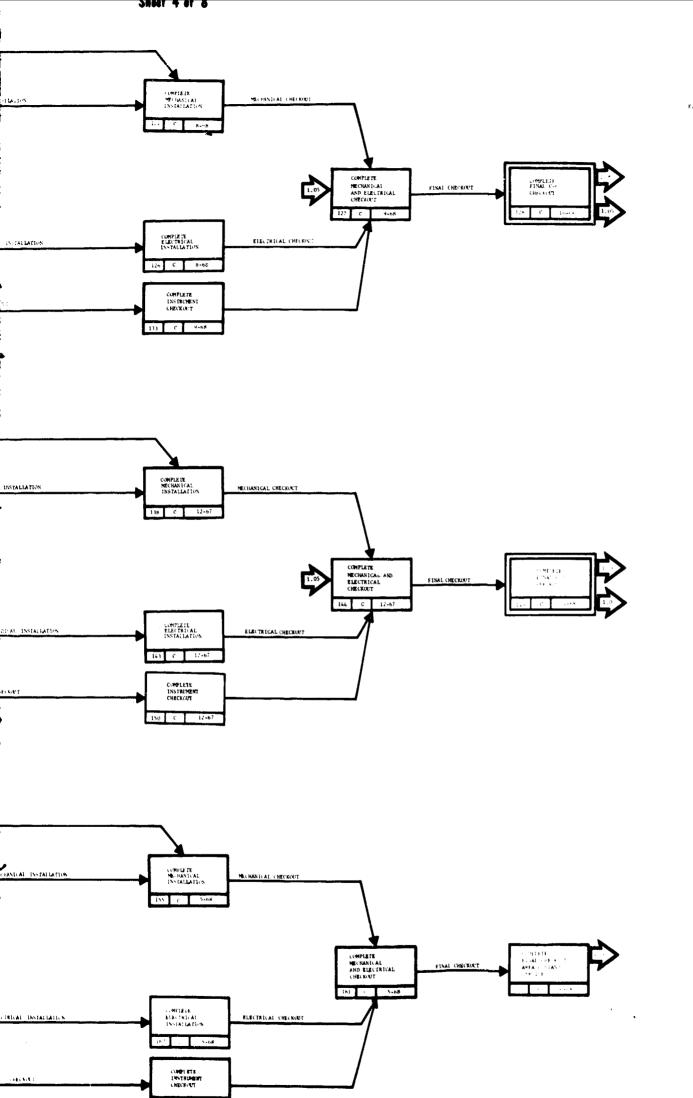
farmoth	t, we can actificate say share
	· · · · · · · · · · · · · · · · · · ·
	• · · · · · · · · · · · · · · · · · · ·
	The state of the s
	Property Commence of the Comme
	e wy y Silva a a Silva
	••• t
••	
•	A 44.1 No. 1.11
	A service of the serv
.*	
	September 1988 A Sep
	(4) A Single Company of the process of the company of the compa
	THOMSEL SAND BALTS KING BLOG SEALE
t.,	Agricol Artist Artist Company
	CARD SACISMENT ANN TANGES OF COMMENT OF A COMMENT OF CO
,	ing and the second of the seco
	 Melysia Marcollo (A. Marcollo (
	CONTRACTOR OF THE CONTRACTOR O

* * * * * * * * * * * * * * * * * * * *	
	CARLON JOBS AND TAY OF THE COMPANY OF T
	 We also share the Mark of the Property of the Mark We also share the property of the Mark of the Mark The Mark of the Mark
	AND FRANCISCO FOR A STATE OF A ST
	A LOST ALCOHOL STORAGE
Figure 5 miles	According to the second

	A	٠.	* *** *	
A#1 -62	11.5	18.5	1130 to 150 to 1	
×200				







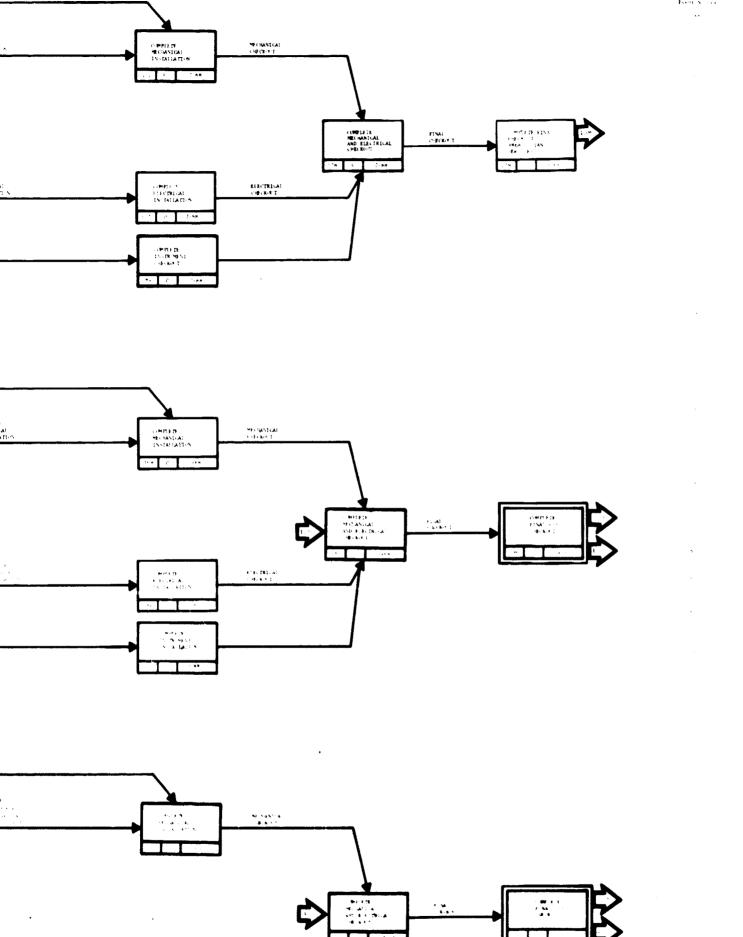
Fin. er i Number	ALTITUDE RAP STAND
ert suspet	
**	215.654
	Market And The
	AND COPY Definite Common New York Common A Common Common Supplied Comm
.*	COMPLETE W.
	and the second of the second o
1.1	
	Programme and
	CAMPLE PARTY TO PROGRAM TO A CONTROL OF THE CAMPLE PARTY TO A CONT
	Table No. 1
	10 (10 (10 (10 (10 (10 (10 (10 (10 (10 (
	185 - 1
	e star cons
*	The NET CONTROL OF THE CONTROL OF TH
	1
	Tall and the same
	415 - 1

	g skale se Se and se se de se
	a determin
	0867 2005-68
	DAY CHANGE C 2 Teat Level 2 Teat Control
	s Kowskow
,	E K TANE TE F
	2 N 1985 F 198 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
	4. 44 4 7 7
	Partie
	t gr
	4.3.1.15 4.4.1.11
	Sir Sir Sir
	i e Maria de la secono dela secono de la secono dela secono de la secono dela secono de la secono dela secono de la secono dela secono de la secono dela secono de la secono de la secono de la secono de la secono dela secono de la secono de la secono de la secono de la secono dela secono de la secono de la secono de la secono de la secono de
	Letter de la companya
	14 4 41
. "	kumbabak ba Kambabak ba
	A TENENT OF EACH OF A TENENT O
	per sisk yo
	CMC CTF MA A COLOR OF A TRUE COLOR
	11.11.
. •	- Militaria
	AMILER OF EACH
	1 1 1 1 1 1
,	Ada Esta San
4.	142 - 142 - 143 -
	•
	4.36
	$\begin{array}{ccc} \phi_{ij}(\theta) & \theta_{ij}(\theta) \\ & \theta_{ij}(\theta) & \theta_{ij}(\theta) \\ & \theta_{ij}(\theta) & \theta_{ij}(\theta) \end{array}$
	* \$1 *
	1973

EVENT DICTIONARY

ALITUDE MAY STAND				
		CR HIGH PRESSURE CONFRESSOR STAND	AREA C HEATED IN	LET STAND SERVICES IST SET OF MACRIMERY
Description and Criteria TAXI IN CRIAIN SIDE FOR ITS ARRANGED CONTROL OF THE STREET S	Event Num er . 64	Descript, in and Criteria START DE URTAIN BIDS. Frejate discusses, susceptionals in an indesign for basis standards, suspects, basis standards, suspects, basis discusses and in one water, petable water, etc., configuration, basis of the control	Event Number	Description and criteria. INCLE OFFICE SIDE Propose fraction, specifications and description form stratures, specifications and description form of traditions. Specific Description, specification, specification, and the specific specifi
Over some engaged, state to obtain MDS. (OMPERE ERLS AND MORIAK (19) (1) First time scattered contact to the contract fisce of Section of Contractors. Morrow on However, the contractors of Morrow on However, the contractors of Contractors.	118	are other Services required. Start to obtain \$100, sometime \$100 and \$100 a	ė	To the control of the
CMMERICAL AND ARRAY CONTRACT Detects cracines, see clearnes and designs to fixe structures, and otherwise in the conditions, and otherwise of clear systems, and otherwise to a local system, and otherwise the clear system, as the asset of the conditions of the clear system, but conditions of conditions, all outbridges are structured as the conditions of the clear system, but conditions of conditions, all outbridges are designed to be considered to the conditional systems of the conditions and levels of the conditions of the cond	10.	COMPLET DESIGN AND ARRAD CONTRACT. Priper trainings specifications and designs for have affected attentions and designs for all this activations, supports and this case affects better than a factorized and contractive same activation, petallic water, etc., occiming states existent seater, there is a factorized and clear testing activation. Here is a factorized contraction and that services required, forces for factorized attacking a factorized and state for requirements. Institute 11 to seaters have been forced as a montar solution of the factorized and factorized activities. EXECUTED THE CONTRACT.	A)	Many manufactures are all processing of the second
GOAR (10) (COLD) Depart with freshess affectives immutions 10 (foreign forest partial and establishes) consists of the forest partial partial and control and c	- 18	Problem Silve Colliness strategies a warrower; for equipment and superity, and install beautiful services Soil as clarificated point, which have strategies soil as clarificated point, which have strategies for those to those interesting beautiful transfer are to locations, makeriess in large days there are to more false with the colliness and specific transfer are constituted with the colliness and specific COMPUTED MECHANICAL INSTALLATION.	134	Property of the control of the contr
ONEON TRANSPORTATION OF THE PROPERTY OF THE PR	144	Install of engagement and execute a control of the reclaims of decision. Verification for engagement on soften in technical accordance with mechanical decision. **PRITY/NAMO DESIGN AND EXPLICATION COMPARIS Detailment at a conceptor of the control of an appendix of the control of the co	4.50	COMMERCIA DE COMPANION DE COMPA
ONCIONAME DE COURS AND ANTIGERA, CONTEST Metro de si antigentation and the contract operation and the contract of the contract of the contract of the Contract of the contract of the contract of the contract of the Contract of the contract	140	To satist, requirery to, THROHASE CHOICES ISO ED Bot todout Portdoss unders the appropriation pairs required for Teachers unders the appropriation pairs Reserve and notices but such as a present pairwise.		DOLLMAN BELVAN DESIGN COMMENTS DESIGNED OF THE SERVICES OF T
10. Second and the control of the control of the particles. 2. Second and the control of the particles of the control of the particles of the control of the cont	s el	CONTENT TO SECTION AND ELECTRICAL MASSIVE PROPERTY OF THE PROP		CREASE SOURCE to app. For and of Parameters as the equipment of papers to extend the memory of the edition of
March S. M. Control and Con	.·	CONTINUE PARTY PROCESSED IN CONTINUE A CONTINUE PROCESSED AND A CONTINUE AND A CONTIN		OMETRIC MEROMENT AND REPORT OF THE PROPERTY OF
The control of the case of the control of the contr	347	GMEETE FIGURE OF THE FALLIUM INSTITUTE OF THE PROPERTY OF THE PROPERTY OF SECTION OF THE PROPERTY OF SECTIONS OF THE PROPERTY	1 - 1	Complete Paris Processes: Complete Paris Processes: Process State Section 1 to Se
The control of the state of the section of the sections of the section of the sec	;.	Statistics and the second of t	,04-	to constitute and a con
(a) A. C. A. C. Governor Springer, Whereas with a construction of the State of Conference. (b) A. C. A.	ies	Operate softe as itelerane of og ignet to operate that the respect of operation and those are satisfied. Observe condition of softeness. SIANI SYAN ARRES OF ROYUNGERS.	401	CONTEST MEGANICA, VIEWS, REAL CLEAKER, CARLON OF ANY CONTEST OF A STATE OF A
 Control of the Control of the Control	, •	Policina se di montre a un'accione para est asserva di man en un'accione de la contrapa di manda di productione di cotto di al all'accione di policina di productione di contra trata con la contra di transitatione di productione di contra di trata con la contra di transitatione di productione di contra di contra di contra di transitatione di productione di contra di contra di co	r.b.	COMPRESS OF ALL OFFICE AREA CONTROL FROM ENGLISH THE STATE OF T
[4] A. Grand, M. G. W. Harris, A. G. W. W. G. W.	ıs	dence de species de la reputatio, comprise. Visto de després de la passion de la compressión del compressión de la compressión del compressión de la compressión de la compressión de la compressión de la compre	, e. e.	[6] S. ANALYATOW Of Brightening Company of the C
Fred Haman Rd. 1998. BENDA. The second se		Order of the course, Order of the control of the course o		A Company of the Comp
The control of the co	,	CSTRIP INSTRUMENT OFFICERS (CSTRIP STATE OF STAT	,	COMPANY OF THE ARCHAECT CONTRACT OF THE ARCHAECT CONTRACT
The second se				With I will have

I



the experience of controls a	Forer Symbol	Description and Criteria	Event Humber	secretario en anti-tistes e
TART 1 (#TAIN HID)	:•	START THE WETAIN BIDS Prepare Transmiss, specific arisens out Bosts of F	***	Application of the property of
		in the first product of the state of the sta		FREE CO.
The control of the co		and the state of the contract		
A STATE OF THE STA		 And the second of the second of		
FARCE TO MEANY FIRST TO STATE THE STATE OF		A STATE OF THE STA		
	***	CHELETE HAGEN AND MINING BUSH		And the second of the second o
The page with the Court of Architecture (Architecture) and Archit		THE SECTION OF THE SE		 Mary B. Sagaret and M. Briston. Mary D. Sagaret and D.
The second secon		Boundary of the control of the second of the second of the second		e e e
	-	CONSTRUCT DESCRIPTION AND AWARD COSTRACT		Mr. E.E. S. D. S. A.G. Awar C. ad.
OM FIRE SOUN AND AWARD SOUTHWAY		regars brawn and people state of the conformation of the conformat		Pr. B. F. W. L. V. A. C. Awar and T. Address of the control of
The first of the second of the		They was considered to the constraint of the con		
Company of the Act of		grafinger withing with the second with the first of the second se		
and the second of the second o		terpolations the development and product of a late.		
ر برخمه میشود به این		gradien in de la particular de la companya de la co		
(a) The state of the state o		provide the force we are good of the first		
ing general organise degree by white terms to fix an incident of the second of the sec		Fig. No. (Box 1) Sept. 18 (Box 1) Sept.		and personal for the second
instruction of the service of the se		Property of the Control of Control of the Control o		And the second s
		(4) (4) (4) (4) (4) (4) (4) (4) (4) (4)		and the first of the second sections of the second sections of
		 Property and Control of the Control of		The second of th
The second secon		A A CONTRACTOR AND A CONTRACTOR ASSESSMENT OF THE CONTRACTOR ASSESSMENT OF		and the second second second section is
representation of the form of the first form of the company of the		the production of the second		A4
				and the second of the second o
(A) Line of the matter of a first of the last of th	:•	SPECIFIE MEDIANICAL INCA TALL NO. District the second of		The first of the
The first of the second of the		 A supplier of the control of the description of the control of the c		are care of
				THE MINARY DESIGN AND EVALUATION METERS
MAIN CONTRACTOR OF MAIN AND AND AND AND AND AND AND AND AND AN		NE IN LARY DE LOS AND EVALUACION - MORES		
		Determine water graphs to consider and one of parameters to safe to transfer with the safe to the posterior for		
The state of the s		•	•	
4 - 4 2 - 4 9 4	. *.	野は飲みが、海の樹木 (1 selficity) 株式 (1 n n n n n n n n n n n n n n n n n n		
And the second s		and property and the second second second		
general state of the state of		which is the property of the control		AND THE SECTION AND ADDRESS OF THE SECTION ADDRESS OF THE SECTION ADDRESS OF THE SECTION AND ADDRESS OF THE SECTION ADDRESS OF THE SECTION AND ADDRESS OF THE SECTION ADDRESS OF THE SECTION AND ADDRESS OF THE SECTION ADDRESS OF THE SE
parting to the manufact, which had take at the had-		COMPOSED MAIN CALL AND ASSOCIATION ASSOCIATION CONTINUES.		
	•	(a) A control of the control of t		
The state of the s				and all the second
The second secon		the state of the s		Maria de la companya del companya de la companya de la companya del companya de la companya de l
Associated the second of the production of the second of t		 A section of the control of the contro		1. (£15.) AME (#. #. %) 1955
Tr.		en yn head ak e kêMe.		
Marine Brook of the MENERS				
Section 1 and the Section 1 an				
f			•	• Property of the state of
the second of th	•	(4) And Andrew Park Carlos And Angel And Angel And Angel		
(4) A. Martin, A. M				
• • •		•		and the second s
		ME BUT ME WAS A AND FUT SHEEK OF DEPT.		and the second s
the contract of the contract o		 All the second of the second of		
		and the second of the second		w
	1.4	W 1.5		
 A second of the control of the control				•
The second secon		A CONTRACT OF THE CONTRACT OF		
		Section 4 No. 6 Applications	•	Control of the second of the s
1986 (1986) 1 (1986)		به فالمخطوعية والمحادث كويت		
		The second section of the second section is a second section of the second section of the second section is a second section of the second section of the second section secti		A THE STATE OF THE
and the second s		スティース No. a in No. a in MacNot (最近は10年間 昭1)。 マイス・マイス・マイス・マイス・マイス・マイス・マイス・マイス・マイス・マイス・		and the second s
		and the agent was the more than a programme and the second		A service of the serv
		A CONTRACTOR OF THE PROPERTY O	*	BO E E R. BERNEY E KE
		program processors a sale		
• • • · · · · ·				
$\label{eq:def_problem} A_{ij} = \frac{1}{2} \left(\frac{1}{2} \left($		The second secon		
		merca:a hotal,ati.m d n almany		en general variable et en
A CALL STORY STATE OF		PRINCIPLE TO TOTAL LATTOR OF THE PRINCIPLE TO SERVICE AND A THE CONTRACT OF THE PRINCIPLE AND A SERVICE AND A SER		and the second s
 * ** * * * * * * * * * * * * * * * * *		 A supplied to the supplied of the supplied to the		
			•	with a common to the
		particle to the service of the servi	•	
NY 3 3 4 WS				and the state of

4

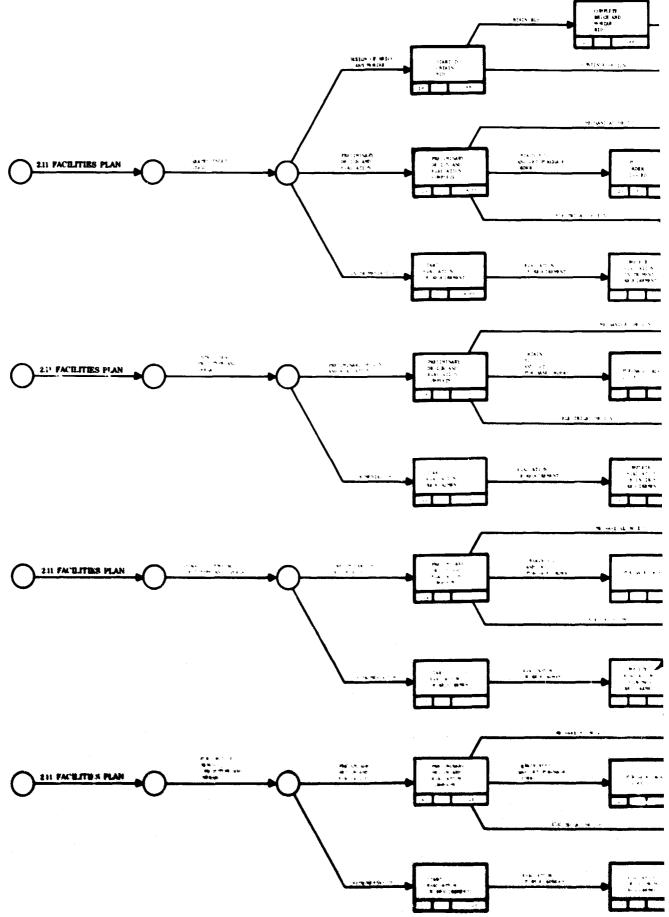
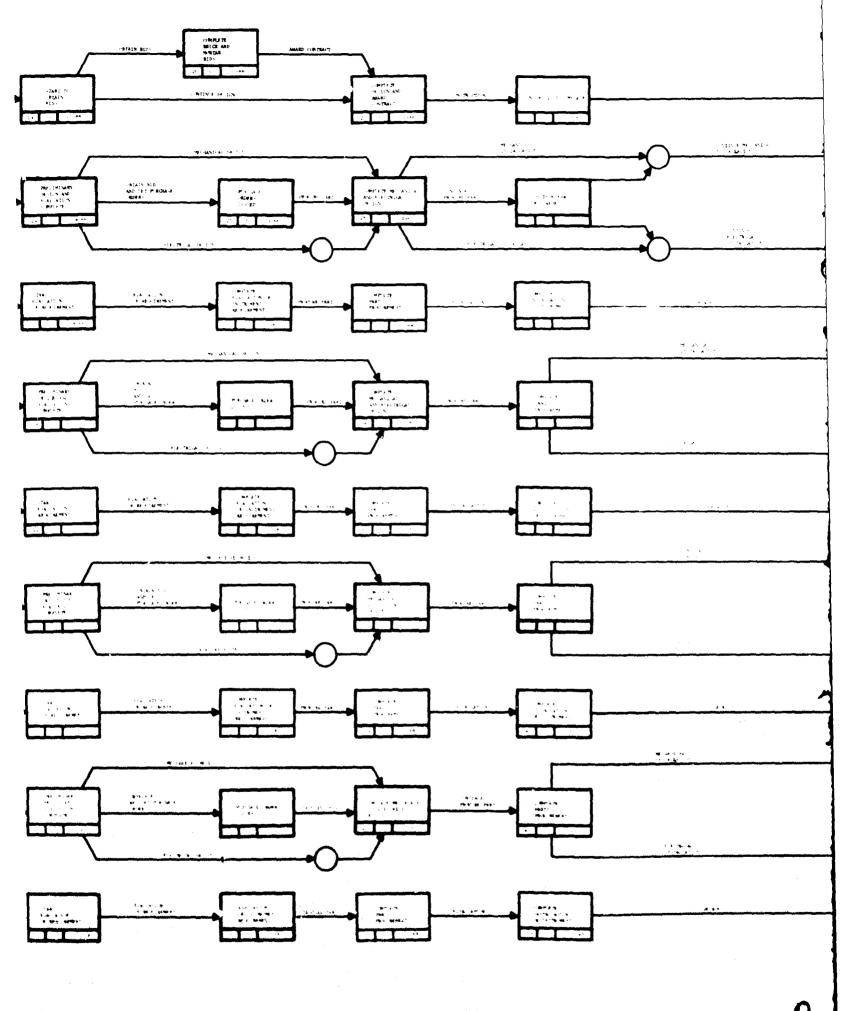
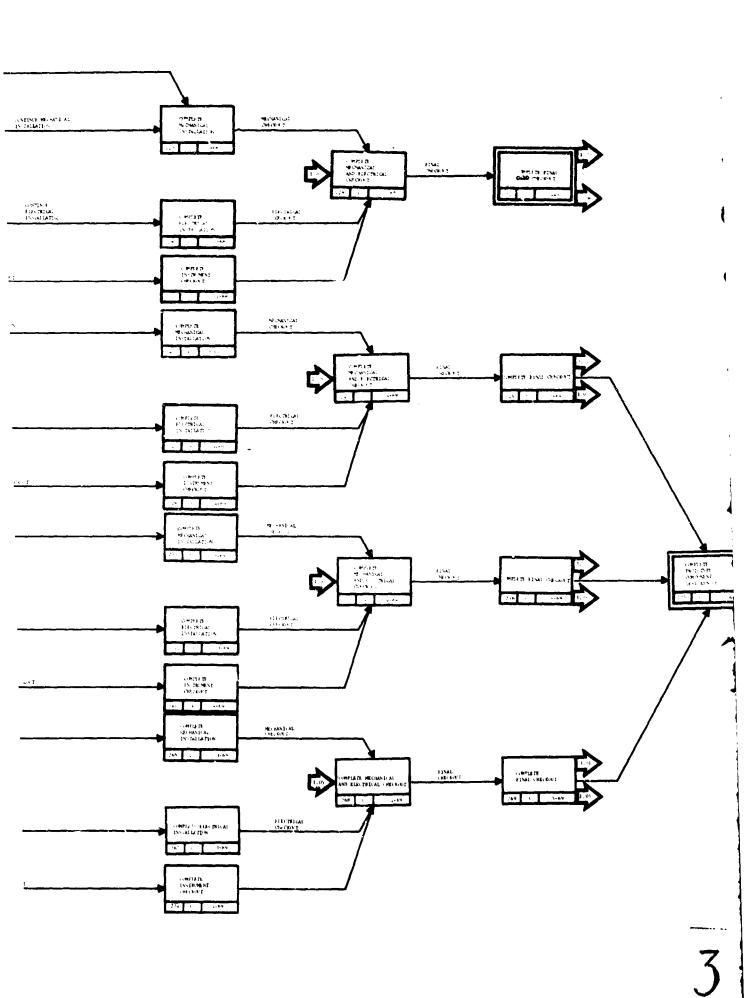


Figure 15. 2.11 Facilities Plan (Sheet 6 of 8)





Copil sees	III IRE 1885
	in a regress and regress,
	MIN'S TO A
· erun	M. S. AN. WHISE TO: 20 If May a size of the control of the contro
	de telegraphical constants
* 10	4 National Control
	• · · · · · · · · · · · · · · · · · · ·
15.50	List regulate
	A THE TOTAL CONTRACT ON THE CONTRACT OF THE CO
	Constitution (1)
	A STATE OF S
P 2.9	THE WAY A STATE OF
•	
	•••
2 .	
P 44 4 1	4214 1 c 1 c 2
	(AZER) (CONTROL F. POTTORNO CONTROL STORY CONTROL
	er i Maria Peter i i Perena i i ri e e e a agente i i e e e e a agente i e e e e e e e e e e e e e e e e e e
	make a second of the second
•	
X X X	FMF PER GOSS
	PART PROCESSES No. 1994 - Processes State of the Contraction Management State of the Contraction
	*
	and the second second
	•
	with the transfer of the
· . · .	
9	. · · · · · · · · · · · · · · · · · · ·
er in	E1841
Service s	erica e en la companya e esperadore de la companya e e e e e e e e e e e e e e e e e e e
	1 41 41 41 41 41 41 41 41 41 41 41 41 41
	All Across Successions, and the second secon
per elle	Fig. 1. Sec. 1988.
ann a	To protect the second section of the contract
Personal a	removed the model to the second section of the second second section is the second section of the second section section section sections section sect
Company of the Compan	to percent of the design exists of the pro- ation area of the control of the cont
	and the state of t
i,⊷i je j	PARTS PROGERENCES
	the eyes of the posts of the control
teresses.	Of the make state on the construction of the construction of the party of the construction and the construction of the construction.
CORPLESS :	PASTALLATION OF IN ROBERTS OF IDELLORS DISTALL CONTRACT A CARLES
	writte status in the lates of pressys-
	OSTALIATION OF IN REMENTS OF INSTRUMENTATION OF PARTIES OF A PARTIES O
Section 19 1	UNSTROMENT OF THE OWNER TO PROTECT OF THE OWNER OF THE OWNER OF THE OWNER OWNER OWNER OF THE OWNER OWN
· immirate	personal and the state of the s

	\\(\text{CE}\)
. •	ATR ARE THE COME AND LEAVE
	THE WARRY WILLY AND ALL AT IN LOW P.
	metation to eat an observation of
	TRUES AND STATES STATES
	 Anti-Anti-Anti-Anti-Anti-Anti-Anti-Anti-
	* - *
	#
	·
	the state of the s
	· · · · · · · · · · · · · · · · · · ·
•	 Model to provide a constraint. See Exercise property of the term of the constraint.
	- · · · · · · · · · · · · · · · · · · ·
•	The second secon
	والعواد المراجع العواد المراجع المراجع المراجع المراجع المراجع
	and the second s
-	CARDIERO ENAZ ALCONO DI UNOS MENCIAZ AL DAMPO DE CALTA DE LA SERVICIO DE LA COLONIA DE LA CALTA DE LA CALTA DE LA CALTA DE LA CALTA DE LA CALTA DE LA CALTA DE LA CALTA DE LA CALTA DE LA CALTA DE LA CALTA DE LA CALTA DE
	and the first of the second section in
.•	
	The Market Annual Section (1992) Annual Sect
	comprehens the contract of the
	MEDIA DASALALAT ON LAND MET. LONG TO SEE TO LONG TO LONG TO SEE THE SEE AND THE SEE THE SEE THE SEE THE SEE THE SEE AND THE SEE THE
	and the second s
	The first section of the control of
	the contract of the state of th
••	HOUSE ITS FOME BENCH PROTETY AND STREET,
	HISTER OF FRINCIPLES OF PROTECTION AND ACCURACY OF AND ACCURACY OF AND ACCURACY OF AND ACCURACY OF ACC
	ediable for variously recommending
	HERETAGE CROSS CONTROL OF STREET OF STREET CONTROL OF STREET CONTR
	the model came agos of the control o
	OBSTANCE MENTANCIAN CONTRACTOR OF THE POLICE OF THE PROPERTY O
	 Because of the other control of the first of the control of the cont
	ALMEDITE FART PROGRESSION
	 Both and description of the product of the product of the contract of the contrac
	constitutions
253	ONFIRE MOVEMENT AND A CONTRIBATION OF THE PROPERTY OF THE PROP
	 Divinite out the loss of section of at the exployment of and seeders are constant on the constant while
**	COMP TO PRODUCE OF THE TABLE STATE OF THE ST
	 Complete the following section of a 15 strong algebras. South the first continues of the continues.
. • •	ou NERE IN MERCHANGON, AND ELECTRICAN CONFORCE (CAMOTERS of the conformal of the symbology of conform
	CONFIER A MECHANICAL AND PRESIDENCE OF PRESIDENCE CONTRIBUTION OF A STATE OF THE STATE OF T
	COMPLETE STRAIT CONTROL I
	specification of Gallery of the property of the control of the con
	contacts one was meet submodule permaters of the contacts
	• .

DE PRIT STAN

SACUR AND PURCHAS STON OUR TO THE WAR AT A COUNTY OF THE SECOND OF THE

TO COMPANY AND A TOTAL OF THE PROPERTY OF THE

And the second s

CARLO PROTAMEN CONTY TO SECURE TO A TO SECURE TO SECURE SECURE SECURE SECURE

The second of th

Thought and the second of the

INCREMENT CONTROL OF A CONSTRUCTION OF A CONSTRU

AT NOT REPORTED

Control Market Programme (Control Market Programme) (Control Market Program Name and all of terrial Than size with the degree spects.

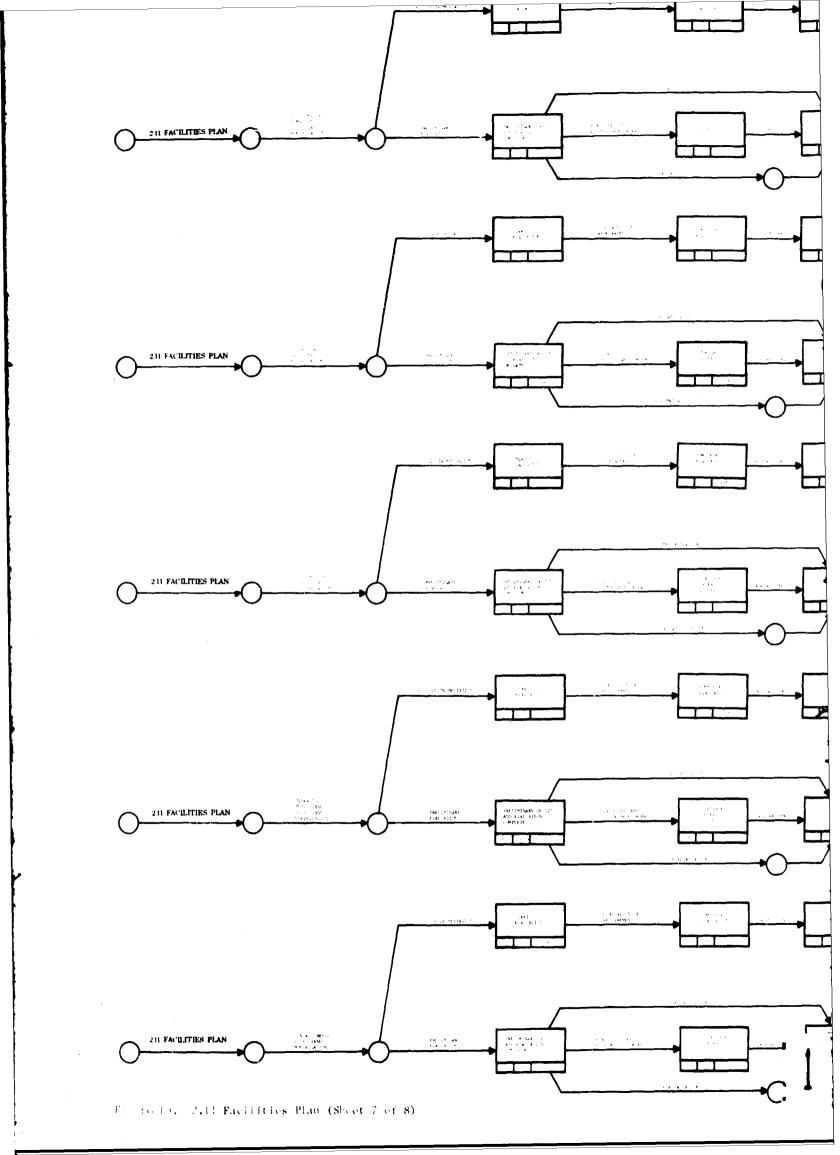
Define the second of th . . Problem End On 17

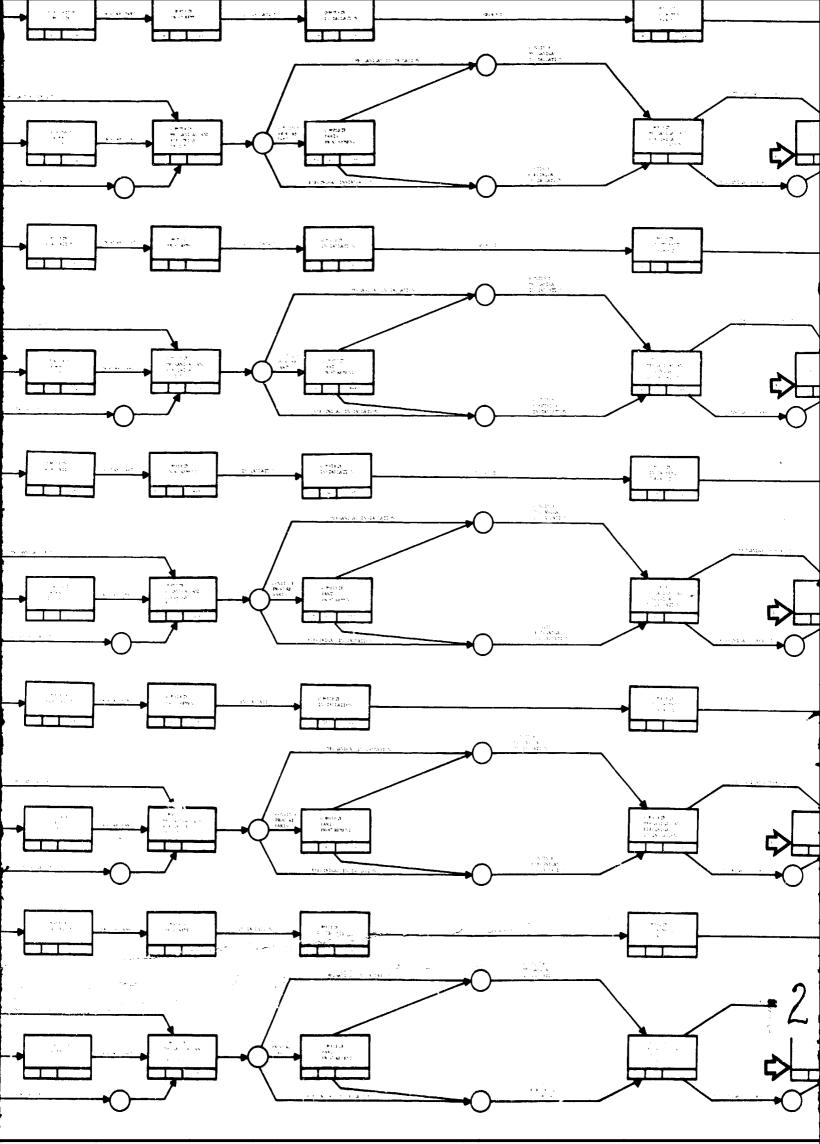
Show of the product of the complex control of the The straight of the straight o The second of th The second secon AND THE CONTRACT OF THE CONTRA | The content of the ## 150 ## 140 ## 150 ## a real contractions and the second se The state of the second Home and the second of the sec WELE A MANAGE TO THE LANDS Compared to the compared to th Help to the month of soft in the control of soft in the A Company of the Comp STANDARD SERVICE PROCESSOR OF STANDARD SERVICES OF CAN, 30A CALLON OF REGISTRATION OF THE CONTROL OF T AND THE STATE OF T A CONTROL OF THE CONTROL OF T CARDINER FARTS OF STREET.

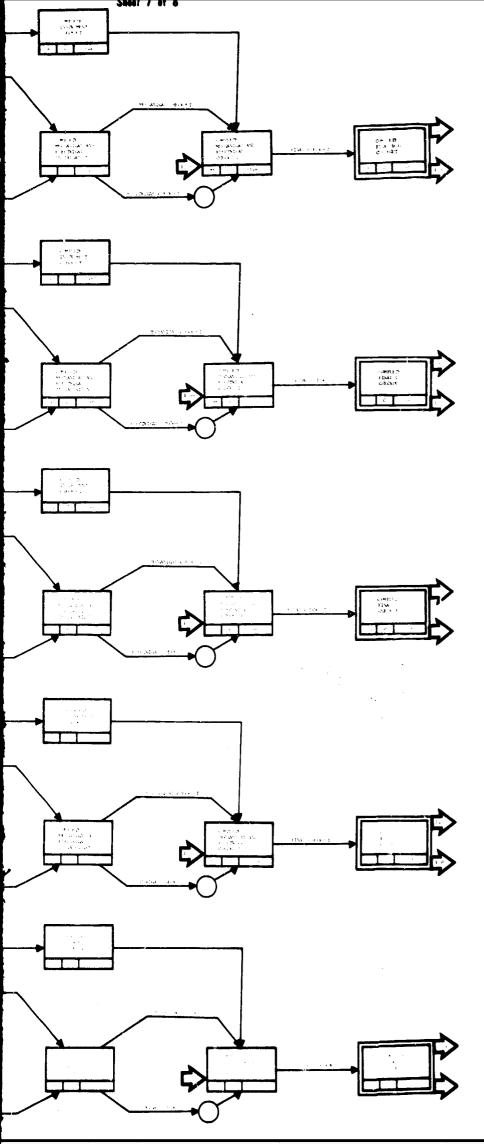
Bod and let a see an experience to another taken control of the see and the GMIDE FARE PROCESSOR, IT IS A CONTROL OF THE CONTRO compete (SMIALIATION OF INCLUMENTS) of fall the instrumentation parts and of specific registro temperature. While the second fall factors of a first fall cause of a first fall CMERGE MODALIA DISTRIBUTION
Distribution of providing to the control of the contr COMPLETE INSTANCES: OBSERVED IN SECTION OF A STATE OF A compage superinted in the provides the ording to the foreign of the foreign that the space of th compositi prototory component is a menumes Constructural becoment outto broads, obtained pump bench and fort service beach ONED TEMPORALIA, AND NOTICE TO REAL TOPASSES AND STATEMENT OF THE CONTRACT OF STATEMENT OF THE CONTRACT OF T content of the project test of the content of the c

PAROPER COPIANT THE SQUAR

FD 17913 VII







THE PROPERTY OF THE PROPERTY OF THE WITHOUT THE

Section 1. Note that the section of the section of

or satisfication (AN 11)

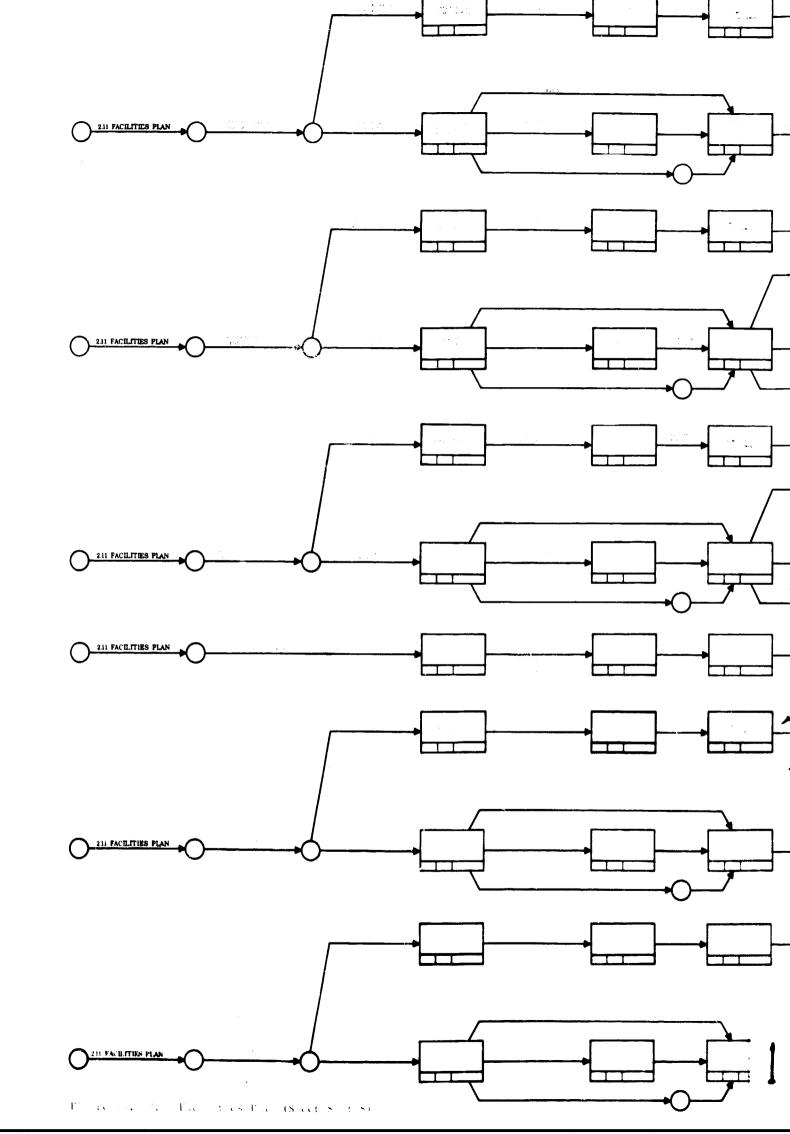
1...

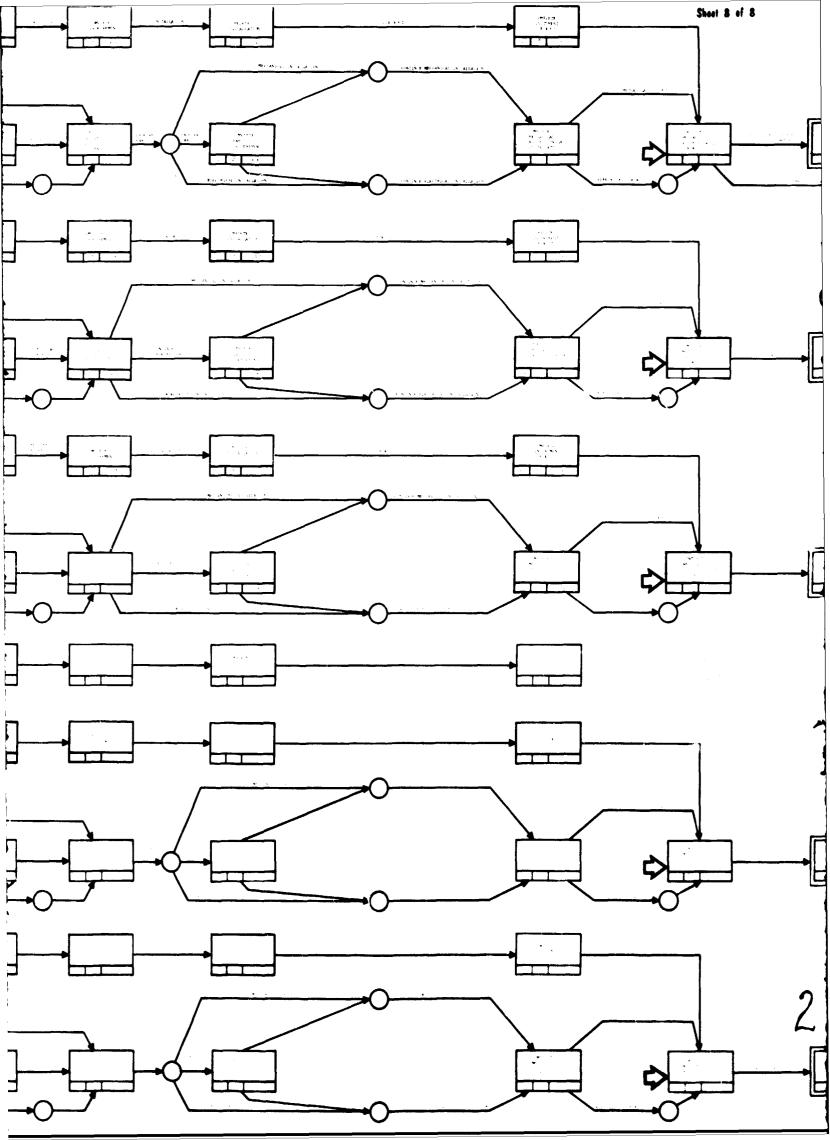
		property of the second	For 5 No.	
e de la companya de l	4.4.4.9			
		CONTINUES AND		
ACTION CONTRACTOR AND CONTRACTOR		Grand Communication of the Com		Committee of the State of the S
Secretaria de Caracteria de Ca				•
Print.				
The state of the s				
a grant		Applying a grant property of the control of the con		
The second secon				
the state of the s				
**				•
The second secon				· · · · · · · · · · · · · · · · · · ·
		Living again throat Method (1995)		
The state of the s				
A STATE OF THE STA				
* *				•
Section 1995 August 1995		Age where the first the first term of the first		description of the second
		 And Anti-Anti-Anti-Anti-Anti-Anti-Anti-Anti-		
A STATE OF THE STA				
				o e
		The second secon		
Control of the State of the Sta				•
		William William St. St. St. St.		
Section 1997 And Sectio				
		and the second of the second o		* * * * * * * * * * * * * * * * * * *
2 - C		surprised to the property of the property of		
A March 1997 Control of the State St	•			
		the state of the s		which we will be a second of the
		Approx Marine Committee Co		
$(x_1, \dots, x_k) = (x_k, x_1, \dots, x_k, x_k) = -2x$				
		 Assessed Assessment of the Control of		and the second second
		enge man engel man bet en		
and the second of the second of				

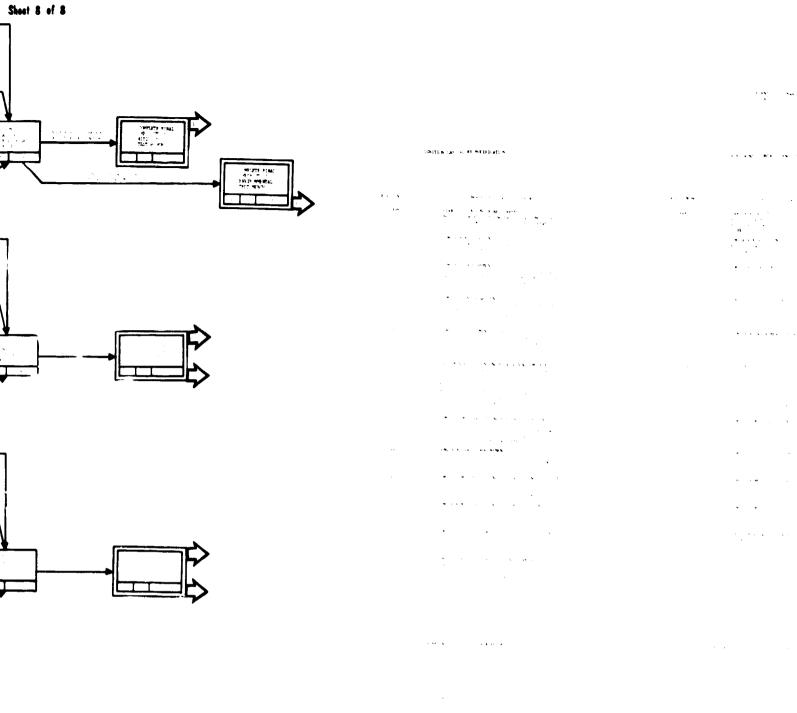
erestate to	- 191	14N0-0-14	MITARITHMS MAIL
or data to		IAN. Sele	

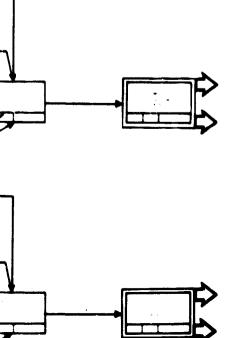
	1		
programme and the second		Alternative North	
AND ANY AND STREET STREET,		Alt Bose States	ψ.
Manager product Asserts and the second secon			
ONE STATE OF		geographic (Asymptotic Control of	
Company (No. 8) A Market and the Company of the Com			
WELLEY CASE MAN THE TANK OF T			
The Control of the Market Control (MICE)	5.* 4		
A CONTRACTOR OF THE CONTRACTOR			
 Section 1 and 1 and 2 and 3 a		garage and the second of the s	
		Carlos Articología	
		A CONTROL OF STREET STREET, STREET	
man and the second second second		e e e e e e e e e e e e e e e e e e e	
		*	

CONTROL RENGAL 15 TAND MACHINE UNIT









.

PLENT NUTT MARK

OUT IN A COMMENTATION		KOPUTBERZ - RETENT FERRICK - T	
		The state of the s	parties - mile 1980 N
and the second second	** **	8	•
And the second s	***	CAP CARCAST STATE OF THE STATE	
		High Control of the C	Section 2
• • • • • • • • • • • • • • • • • • • •		• 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	e processors
			•
Section (Section 2)		**************************************	• • •
		A *X = A A A A A A A A A A A A A A A A A A	•
			• • • •
and the second sequences		•	
		• • • · · · · · · · · · · · · · · · · ·	
			• • • • •
•			
A second of the			
And the second s	•	engles of the second	
•			

PWA FP 66-100 Volume V

2.12 COST ANALYSES

Pratt & Whitney Aircraft will provide the following cost functions to support the JTF17 engine program cost requirements during Phase III:

Cost Baseline Report (Reference Volume VI)

A report will be prepared and submitted annually on 15 September for the updated Phase IV and Phase V Cost Baseline Estimate. This report will be presented in accordance with Formats A, B, C and D for Phase IV and Formats A, B, C, D and G for Phase V.

Report of Funding Requirements

An estimate will be prepared annually on 15 September in accordance with Article XVIII of the Contract indicating the maximum allowable costs expected to be incurred in the following fiscal year.

A complete description of cost analyses is presented in Costs, Volume VI, of this proposal.

PWA FP 66-100 Volume V

と できたをまる 大変な 大変な かっこう

2.13 PROPOSALS

The Contractor shall submit definitive proposals for subsequent phases as required. The Contractor shall also prepare and submit a firm, detailed production engine specification including appropriate performance warranties. This specification shall include the then-current "production design objectives," defined in Article XV and the preliminary model specification referenced in Exhibit A, as such objectives may have been changed in accordance with Article XVI of this contract. Together with this specification, the Contractor shall submit a detailed statement of such additional warranties and guarantees as the Contractor may then be willing to make.

PWA FP 66-100 Volume V

SECTION III DELIVERY AND PRODUCT SUPPORT

3.01 GROUND, TAXI, AND FLIGHT TEST ENGINES

During the Phase III program a total of 20 JTF17 engines will be fabricated, acceptance tested, and delivered to the airframe contractor. The first four engines will be delivered prior to completion of engine FTS for ground test use. If required, four additional engines will be delivered for taxi tests in the aircraft program, and it is planned to modify these engines to the FTS configuration for use during the 100-hour Flight Test program. All schedules and charts are based on the use of four taxi test engines in the program.

The major milestones, network chart and event dictionary for the ground, taxi, and flight test engine program are shown in figures 1 and 2, respectively.

A detailed description of the ground, taxi, and flight test engine program is presented in the Test and Certification Plan, Volume III, Report E, and test planning and integration is presented in Test, Volume IV, Report E.

3.01 GROUND, TAXI, AND PLICHT TEST ENGINE SCHEDULE 4 GELIVER POORTH REPUBBISHED TAXI TEST ENGINE DELIVER SECOND REPURBISHED TAX; TEST ENCINE DELIVER THIRD REPURBISHED TAXI TEST ENGINE DELIVER PINST REPURBISHED TAXI TEST ENCINE CONTIETE 100-HR FLIGHT TEST PRICEAM 1. SEA LEVEL TEST STANDS 2. AEJC TEST FACILITIES DELIVER ELEVENTH PROTOTYPE ENGINE DELIVER SECOND GROUND TEST ENGINE DELIVER PODETH GROUND TEST ENGINE DELIVER THELFTH PROTOTYPE ENGINE DELIVER SEVENTH PROTOTYPE ENGINE DELIVER FIRST CHOUND TEST ENCINE DELIVER THIRD GROUND TEST ENGINE 3. AINTRANE TEST SITE DELLIVER POURTE PROTOTYPE ENGINE DELIVER EIGHTS PROTOTYPE ENGINE DELIVER SECOND TAXI TEST ENGINE DELIVER FOURTH TAXI TEST ENCINE DELIFER SECOND PROTOTYPE ENCINE DELIVER THIRD TAX! TEST ENCINE DELIVER SISTS PROTOTIVE EXCINE DELIVER TEATH PROTOTYPE ENGINE DELIVER FIRST FACT TEST ENGINE DELIVER FIRST PROTOTYPE ENGINE DELIVER THIRD PROTOTIVE ENGINE DELIVER FIFTH PROTOTYPE ENGINE DELIVER SIXTH PROTOTYPE ENGINE ENGINE CENTIFICATION START PHASE 111 ENCINE PTS FACILITIES

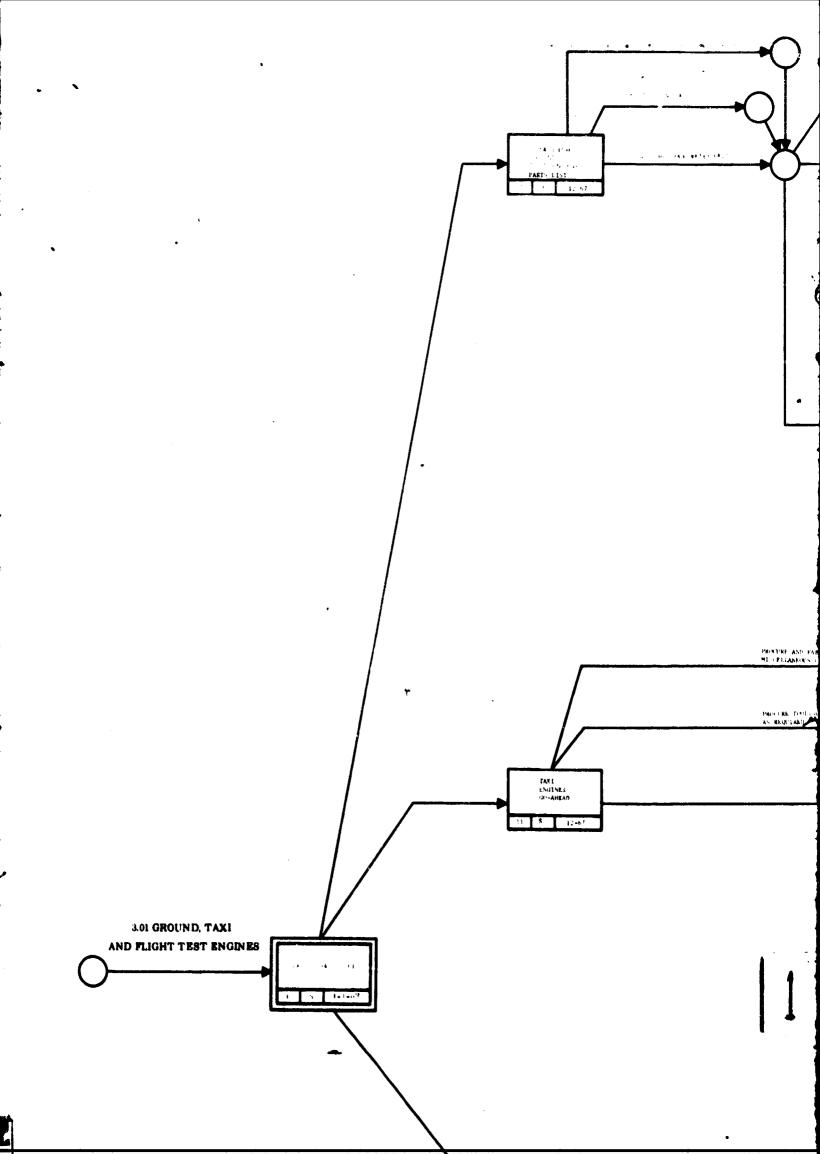
PWA FP 66-100 Volume V

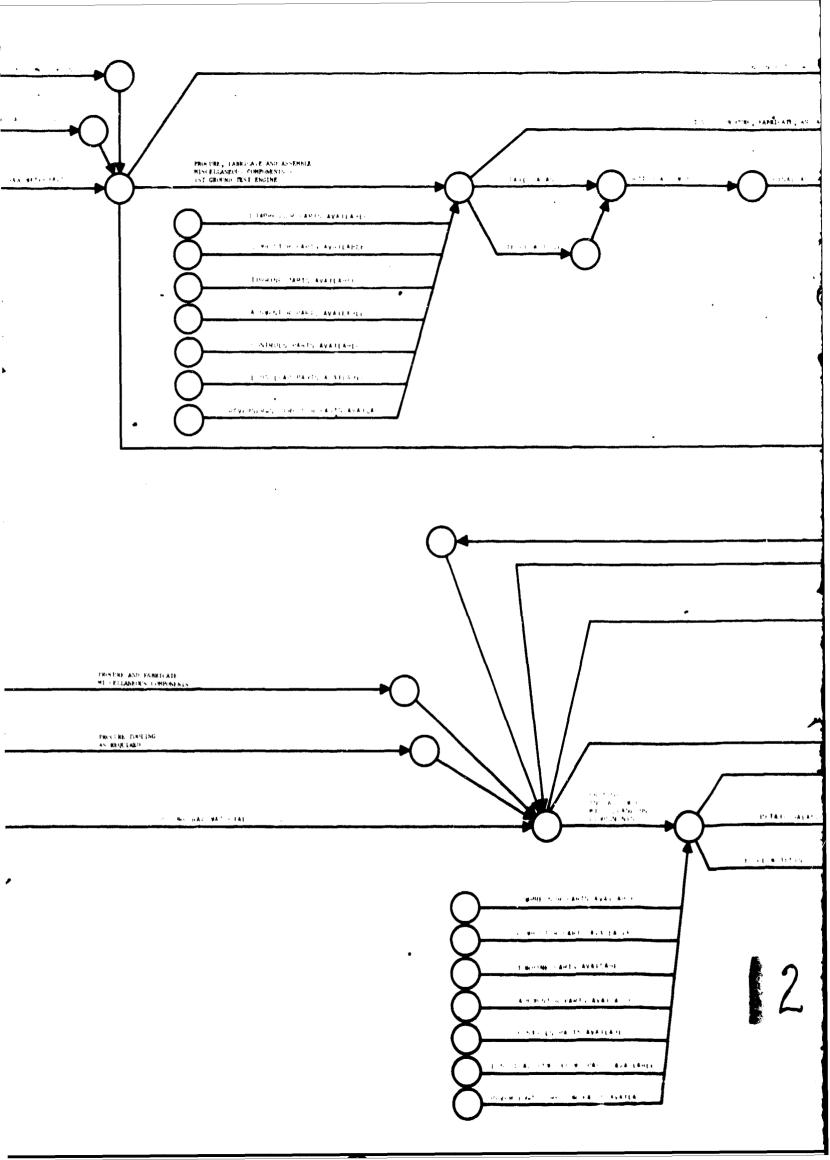
FD 17889 E

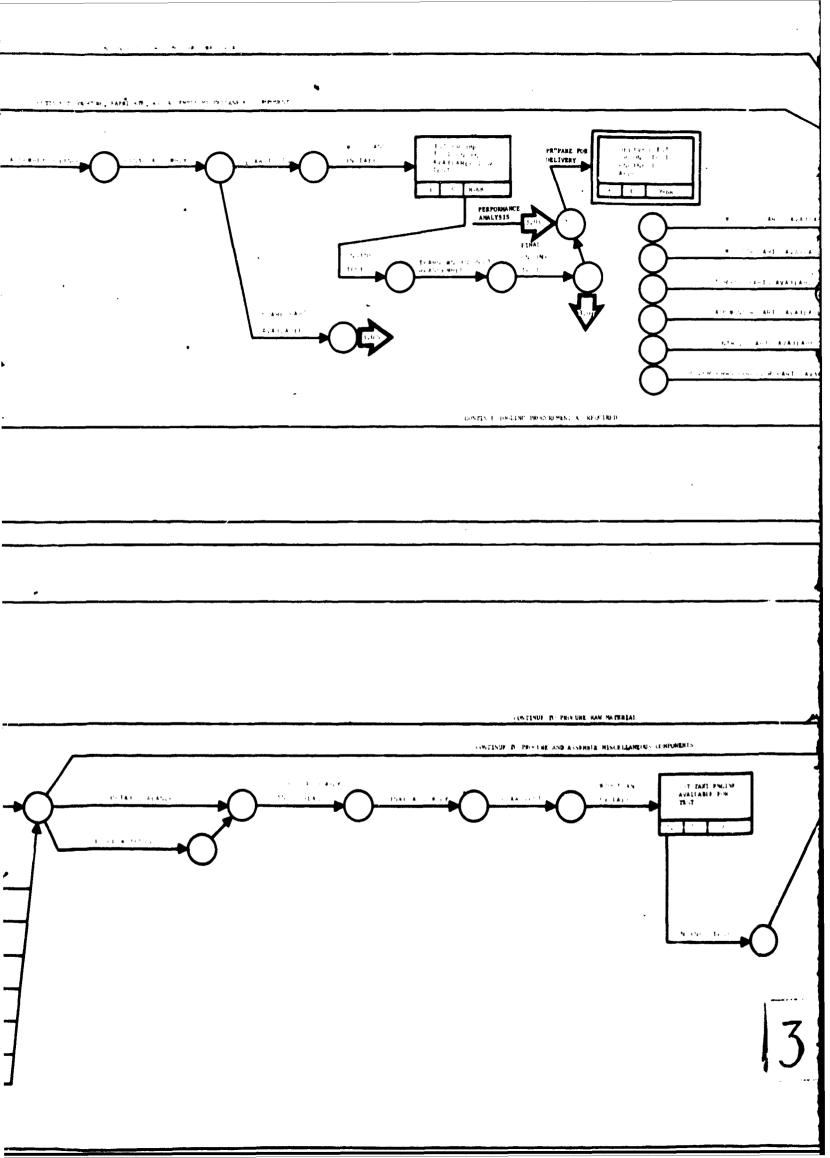
SPERIOR PROPERTY OF THE PROPER 1971 1970 1969 1967 DELIVER SECOND REFUNDISHED TAXI TEST ENGINE DELIVER POURTH REPURBISHED TAX; TEST ENCINE DELIVER THIRD REPURBISHED TAXZ TEST ENCINE BELIVER PIRST REFUGISHED TAXI TEST ENCINE CONTLETE 100-SR FLIGHT TEST PROCRAM DELIVER ELEVENTH PROTOTYPE ENGINE DELIVER TWEIFTH PROTOTYPE ENGINE DELIVER SEVENTH PROTOTYPE ENGINE DELIVER FOURTH PROTOTYPE ENGINE DELIVER SECOND PROTOTYPE ENGINE DELIVER FIFTH PROTOTYPE ENGINE DELIVER EIGHTH PROTOTYPE ENGINE DELIVER THIRD PROTOTYPE ENCINE DELIVER SIXTH PROTOTYPE ENCINE DELIVER HINTH PROTOTYPE ENCINE DELIVER TENTH PROTOTYPE ENGINE

ENGINE CERTIFICATION

3.01 Ground, Taxi, and Flight Test Engines Figure 1.



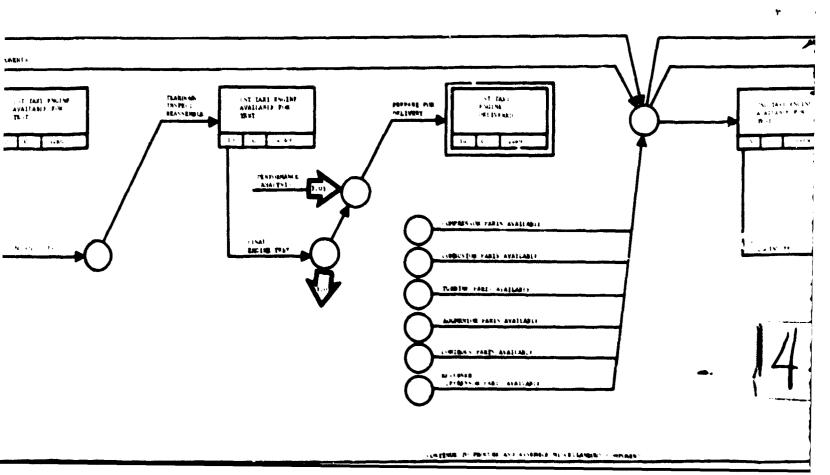


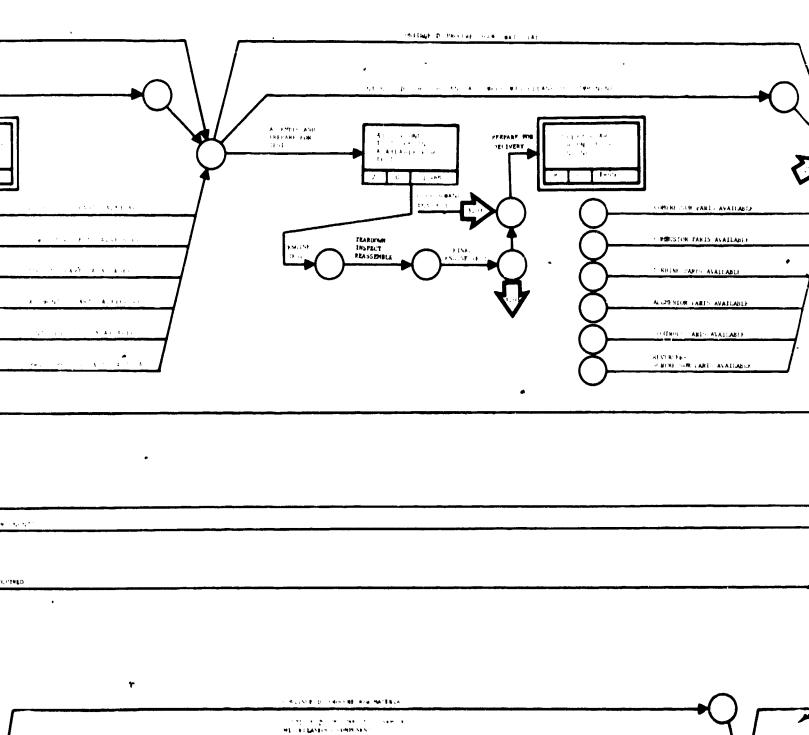


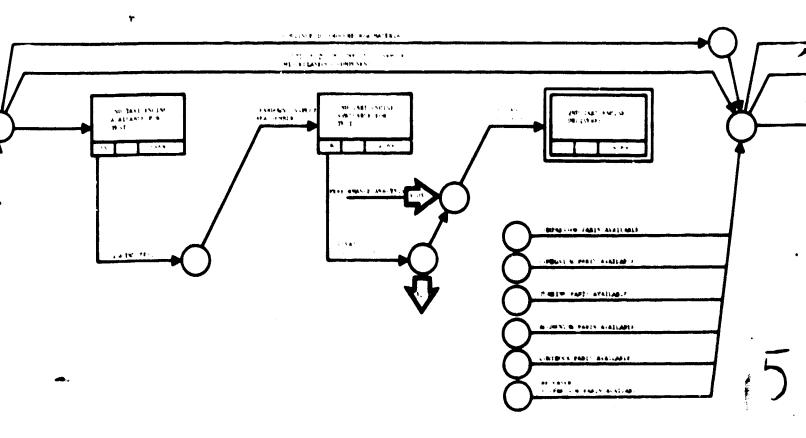
O NITNUE DE PROCURE

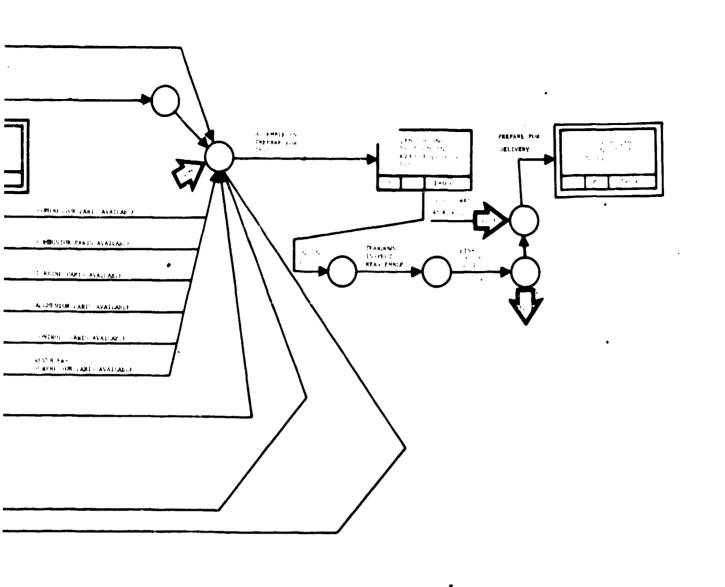
CONTINUE TO CHOK CHE LET, A. WOLL WILL I A. R. W. M. MACCO

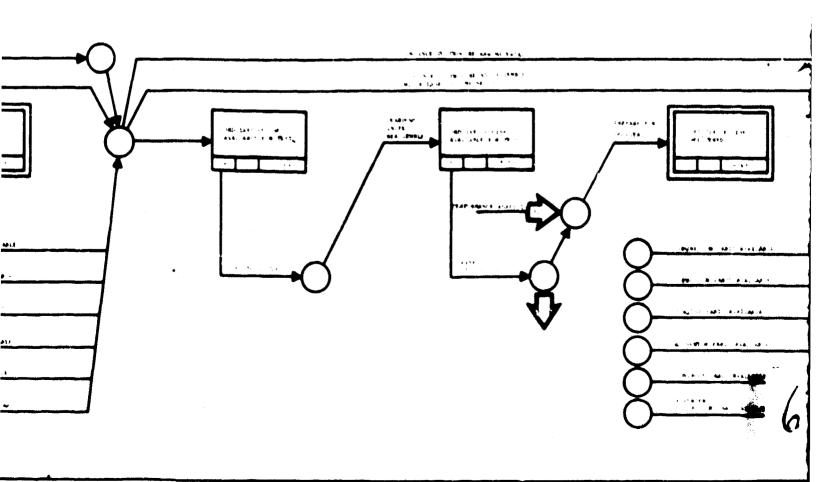
CONTINUE TOULING PROCESTAND AS REQUIRED



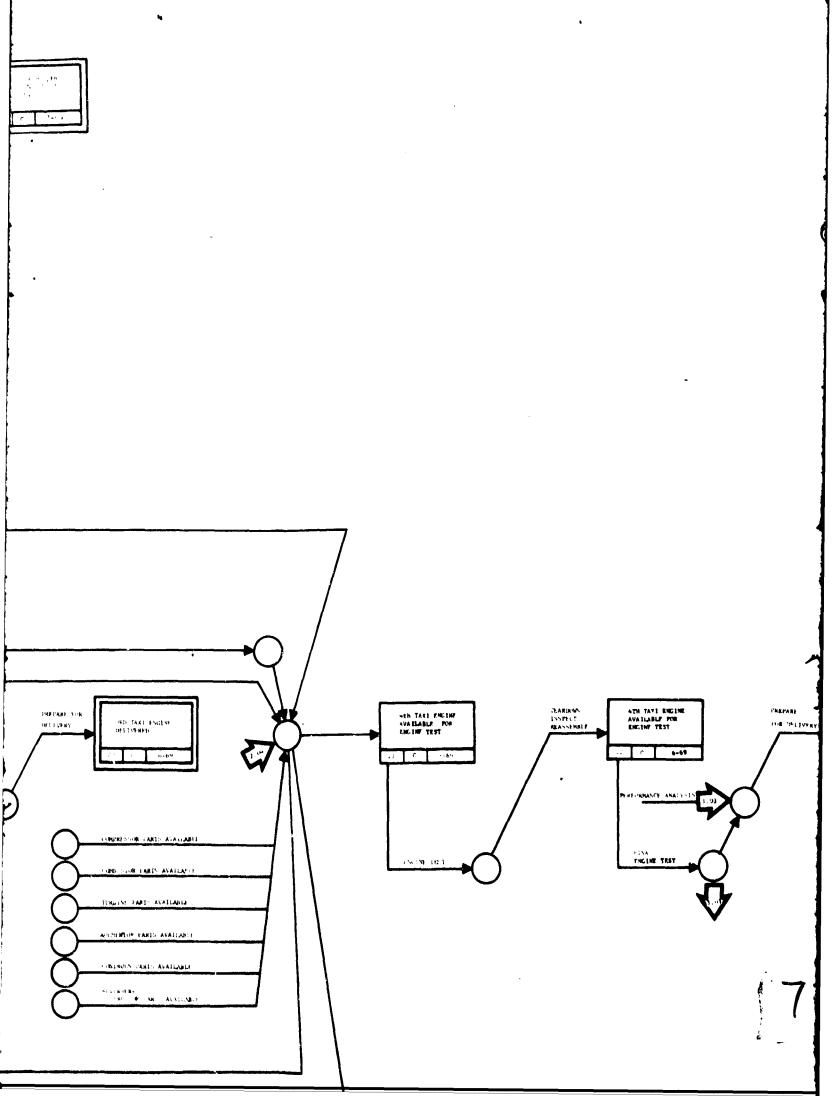








3.01 Ground, Taxi and Flight Test Engines



TEST PREPARE 110E DELEVERY CELEVERED 4-69

Property of the control of the contr

Access to the College	Contract of the second			
	tant regret .		December 1997 Community States	* 44 * N 4*
	Part of a control of the second secon	•	<pre>120. Fid INE Covering ap</pre>	<i>\$</i>
•	 Boundard Boundard State Control of Section 1998 (1998) Boundard State State Control of Section 1998 (1998) Boundard State State Control of Section 1998 (1998) Boundard State St		The state of the s	
	part :		TO DARK ENGINE ACAD A POSSION TENSOR TO THE TOTAL ACAD ACAD ACAD ACAD ACAD ACAD ACAD AC	
	TO GROW THE CONTROL AND CASE FOR THIS TO THE CONTROL AND CONTROL A		terry (10), rallic, or the execution of the execution	
	 As a first of the first of the		The LANCE POLICE AVAILABLE 2500 CF : The last transposition of the residence of the company of	
•	(M.C., China, C. C., China, W. C., China, P. C., Marcha, C. C., China, A. C., China, C. C., China, China		·	
	But we will be the control of the second part of the control of th	•	The TAXI PROGRAM OPERATORS Deliver the fit taxis with marker was provided from the transport for worthing on subspects.	. 6
	The CPA Modern Found Available 166 (Dec.) of the control of the first state of the control of t		TME DATES IN AVAILABLE FOR DEST. The recent time cannot be ranked for exception to the formation of the process and the formation of the process and the proce	
	Construction of the Constr	•.	TND TAXE FROM A AVAILABLE FOR TEST 1 (1) on the second case of the test of the second case of the second cas	
	Bender Frank (D. ORON NO. 18 of C. No. 104 (D. ORON BAD). Bullower B. Golden, and the control of the		the angulation of the test stand for or picts	
	 (a) Section of the description of the section of the	•	AND INCIPALING DESIGNACY CONTROL DESIGNATION OF THE ACT OF THE TENNER OF THE ACT OF THE	
	ORE OROCHO ERNE PE THE ASSAULABOUR BORE EN E. The Clare or professor of the second of the Control of the Figure	4.	•	• •
	for $x_0 \in \mathbb{R}^n$, $X_0 = \{x_0, x_1, \dots, x_n\} \in \mathbb{R}^n$, where $x_0 \in \mathbb{R}^n$, $X_0 = \{x_0, \dots, x_n\}$ for $x_0 \in \mathbb{R}^n$, $X_0 = \{x_0, \dots, x_n\}$ for $x_0 \in \mathbb{R}^n$.	·	(6) TAND ENGINE ANALYMETE FOR THE STATE OF THE LEGGLESS AND THE LEGGLESS AND THE THE ANALYMETER AND THE STATE OF THE ANALYMETER AND THE STATE OF THE ANALYMETER AND THE STATE OF THE ANALYMETER AND THE ANALYMETER ANALYMETER AND THE ANALYMETER ANALYMETER AND THE ANALYMETER ANALYMETER AND THE ANALYMETER AND THE ANALYMETER AND THE ANALYMETER ANALYMETER AND THE ANALYMETER ANALYMETER ANALYMETER AND THE ANALYMETER	
-	 Bernstein (1998) and State (1998). Bernstein (1998) für der State (1998). State (1998) für der State (1998) für der State (1998). 	19	ord taxi engine available for test. The trick the confine is could be trouble to trouble to the confine trick of t	• *
	fig. 2 to find no operate to 1 consequences appear and GROUND PET CONTROL AND GRADE TOWN TEXTS. The first Control to the operation in the operation.	D	ONE TAXE ENGINE LIFELYERED. DESIGNED THE TWO THE CONTROL OFFICE COMPLETIONS THOMAT.	.,
	to the control of the	.;	test room. The engine is a upper. THE CASE EDGINE AVAILABLE FOR IPST THE CONTROL that engine is not why for passen in the first	1;
1	OFFISTR OIN CHANGE OF TEST COURSE		inc. Is installation on the tantil complete.	
	Belases for otherwood feet casans. The careto and fine feet our capitation. The exact feet appeal,	<i>\$</i>	alf TAXI ESCINE AVAITABLE FOR (ES). The fourth first employ is ready for firmal recting. He in religious on the test stand a secondary	

Fig. 60 och Annie (Fig. 1).

				s, a Restan,	or a Applitude
	TANK NO. AT	orsetaptik - mil tilteria - *	10 15 1	New migrators are interested as	1.5 % %
		-116 -1400 - 150 - 100 - 100 100 100 100 100 100 100 10		UND PROTOCY, in the INE ANALYSIA FOR THE	
rrai. - 20-1		D. Dieva is a settlich ers ensume better av aplantions flores to a source of a compare to a support.		The excess partial promotive as a first for each a twint of the monother terms of the District and partial.	
t.	• •	REPURBING A DATA ENGLISH OF SAMEAR TO SERVE AND A SERVER OF A SERV		SE ORTOTY ERATOR WANTANTE FOR PER	• •
		to the profetope of the ration thereoned not consider the control of the ration of the control o		The experience that it was a first than the first term of the firs	
		153 A.B. 250 TAN FOULNESS MET HOUR FOR REFURBLISHED. AND REPLIED BY THE SECOND CONTRACT OF THE SECURITIES OF THE SECOND SECURITIES.	٠.	The meeting is No. 2019 (1974). If it is a first protection is a monotonic completion than the first process of many monotonic completion.	
Telephone gradie		from the tractor for refer a new to the protocopy outform two made to believe to the partition of the con-	4	ORD EMPLOYAGE FOLICH AVAILABLE FOR IN I The India protestion of the incident for each of	
		tractor. To expanse are received from the wis- trace contractor.		reflection processing and the following section of the following section is a section of the following section of the following section is a section of the following secti	•
riang termi	.•	THE ASIS OF BLACK FROISE, RECURSED FOR REPURBISHMENT AND REDELIVERY	**	ORD ROTOTY E ESCUSSION AGAILABLE OR THE	
size to the		To brought by the enchors returned from the niverage and a contractor for to find about to the prototype		he third protests on a deal of the first ter- ing. To instablish on the total and is on place	.n
na sapteta. E		codescration and redelingry to the authory con- tractor. To emphase agreementation is airtima- contractor.		organisation and in the property of the state of the stat	
, a desda vi Lapiado	•	Proceed with the present of the material, toolship.	is.	119 1 ROTOTYPE - NOTSE AVAITABLE FOR 11 -4	***
ti i li a		and things at; we all points for the prototype counties. Government content trop (FAA)		The foliate projects as concerns a consider for necessity of the transfer of the foliation	
		Escita FIS		or plate	<i>e</i> *
on to te		Reference engine outwork 1,000 for a scription and effective		[1] PRODUCTOR AND INCOME AND A PARK CONSTRUCTOR AND A CONTRACT OF THE ARCHIVE ARCHIVE AND A CONTRACT OF THE ARCHIVE ARCHIVE AND A CONTRACT OF THE ARCHIVE ARCHI	
i to pitte	. "	IST (ROTOTYPE FACINE AVAILABLE FOR LEST The first prototype engine Corondy for steen for		THE CHOPOTYPE EXCISE DILLIVEREE .	**
eteti. plete.		to tapp. The anstellation on the test stand is cooperate.		Define the effect of the probability of the field p . The field p is the field p is the field p in p in p is the field p in p	
ita sa kacamatan ji	e.	ISL PROTOTYPE ENGINE AVAILABLE FOR TEST In first prototype copiac is ready for final fectors. The installation on the test stand is complete.	-1	THE PRODUCTY OF A PARTICLE OF THE TEST OF THE PRODUCT OF THE PRODU	
	4.	ist emologype escinf DallyerED Deliver the lit prototype cupins within carpleting		THE PROTOCALE FACING AVAILABLE FOR TO I	
e and tests explor		tinal test time. The entine is shapped.		The fifth projection occurs to ready for this body to the fig. 1. A first Glarion on the read stant to complete.	

nel te tto Splete #1 IV, BECCHOMAKY - 835 - FROMEN, 1962 AND 2012 Har DESCRIPTION

	responsible to the re-	Description and tribbetta	6.400	be cripties and friteria
• (1891) (ds. 1891) - 1888 (1991)		(i) RMAPPER and MAPPER BEAUTIFF THE ACTION OF THE PROPERTY OF THE ACTION OF THE ACT		the emotions a course Adaptable 1980 (E.). In odds, prototype economic acts of the facility to long, as a second of the test of the facility and only the facility and of the facility and only the facility and only on the facility and only one of the facility and one of the fac
tital	• ·	(i) POPOTATE CMART AVAILABLE TOR (E.) The rest profit, as a present coals for one of the rest. (i) The transfer the community of the first contract.		off descentle and the letter because of the settle to be presented to the settle to be settle to
ds for the Life section is a complete.		CONTROL PAGENTAL ANALYSIS FOR 1551 Leading of the control of the function of the first transition of	e .	* THE ENGLISH PRODUCT AVAILABLE FOR THAT I.e. cost. From type on the increase for ground and to record the period progression of the state of a public.
Agram (a	•	car yesterne thouse bitariskib believe the or protestype made after we plotte it so to thouse. To see the in appear		our property follows and the first December 1988 of the first sections of the first terms
en trans	,	The PROPERTY PARTY AVAILABLE FOR THE L The county prototope course is ready for cross and read and the context arrows to the forteness.		TOTAL PROTOTYPE ENGINE DELIVERS: Deliver in 1919 - retotype elected attendes giotzag Eyesi test range i electeda in Cippet.
to finite to to tand a complete to complete.	.4	THE PROPERTY OF AND ANALYSIS FOR THE CONTROL OF THE	1	1218 (ROTOTYPE EXCENT AVAILABLE FOR TEST Earlies of Predicting Contact Transport of Creen For Computer Computation and Contact Contact Computers.)
(Processing and American Ameri		(i) Reserve the ENT DELIVERED below the topic toron enemy alternative conductions and the entire the support.	PC .	TITH PROJUCTED ENGLY ANALYSIS FOR D
CARS:	e.	 Lot ROPOTED CHOCKET ACADEMIC CORP. IT of The control of proceedings of the state of the control to the procedure. The Page Control of the Control of white. 	и.	1) THE CHOISTYPE FORTH THE INTERPO DESIGNATION THE CONTROL OF THE CONTROL OF THE CONTROL TWO CLOCK CONTROL OF THE CONTROL O
to potent	,	STP SUPERING LABOUR AVAILABLE FOR THE LABOUR STREET TO SEE THE LABOUR STREET STREET TO SEE THE LABOUR STREET STREE		27H BROTHY'S FYCEL AVAILABLE OR THY Le Declite protesta entire is ready for environmental fields, Technical attended to test configuration.
pped., If sa If or the live is not said the sa	er.	MELTROPONY (PAGING DELAYERD Belg control Mit products produce of the control plants, from the former. The extension of Epice.	• *	THE ERRORMAN PROJECT AND THE TOTAL PROJECT OF THE P
H 1	,	The CONDUCTABLE PROJECT ANALYSE (CONTROL SEA). The Control of products promotive for each for the control of products. A control of the control of the control of products.	,	12TH PROTOTYPE FACIAL DELIVERAD. Believe Go little prototype kingine after completing treat to trains. To excluding the adapted.

11

. .

10.7

ATTABLE 198 (E.)

OF THE MARKET THE LAST TO THE COMPACT.

TOTALED

TO THE ATTACH OF PARTIES

THE ATTACH OF The BUERBRICH TAXI FACTOR AVAILABLE FOR A F Return Court of the let factor year terms proto-tive conflictations of complete and two courses, available for test, institutions of the test stone to expect. scullable resident stable to organic Deliver in the PRASHED FAST (Notice Deliver to a fitter engine a farther of the respective from the terms of the fitter of the f VANDALDE FOR (FN) professors for klose for moreons of test stand f CMD REP MRISHED TAXLENGINE AVAILABLE FOR B 4 Returned both of the addings ending to the proof type configuration as complete and the continuous conditions and the continuous conditions of the transfer of applies. AALABIF FOW SFEEL recal results for trial to te-ration feet class recomplete. FINENCE

Specification of the completion

Line A. Cippera

ALLARDE ON THE TEST

LODGE TO THE ACT THE TEST

LODGE TO THE ACT TH DELIVER AND REPURBISHED TAXY UNLINE
Holiver the lad took engine relandable to too proto-type configuration after completing final cost energy flue will be the last prototype energy, the one in a stapped. ORD REPORTSHIPD TAXE ENGINE AVAILABLE FOR FISH Beloebistsont of the Auditorian confer to the protocyte configuration is complete and the coping associable for test. Its religious on the test stable complete. . . ATTABLE FOR THE T continue to to off two through traffall IVERED the contraction of plots come from these Beliver the full masses, for inverse to the processes of ignation of the completion from the first for the processes of interest of the completion from the first first for interesting continuous for community stipped. AllABIE FOR IESE - Los de reade for creer en copier de test camb i THE REPURKING DIALITY ENGINE AVAIDABLE FOR THE RESIDENCE OF THE ACT OF THE POINTS OF THE PROPERTY OF THE PROPE CADABLE FOR IES!

GAIN IN ECONOMIC TOOLS

SOURCE TO ECONOMIC TOOLS

SOURCE TO ECONOMIC TOOLS DELYER OTH REPURSASHED TAXI FACING DELIVER the state of t HIIVERED Representation completing two mosts of appenda COMMITTE SUSTAINING ENGINEERING FOR TOCHNAR ALTGUIT TEST.
Fod of Phase III. Compacts of 200 to a thirt

Figure Anathria Descriptions and conforma-

. •

FMCINO CERTIFICATION RETURN TO CONTRACT OF THE CONTRACT OF T

THE STREET AND THE STREET WAS THE STREET WAS TRAINED TO THE STREET OF TH

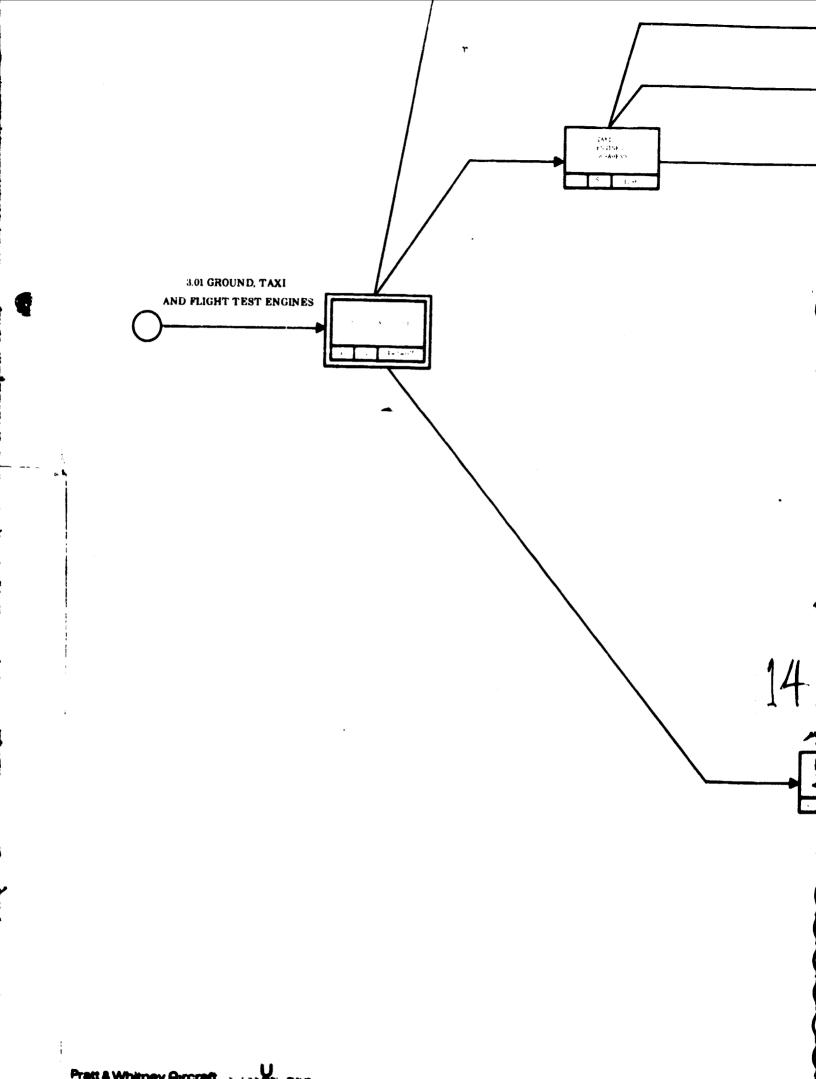
s 10-69

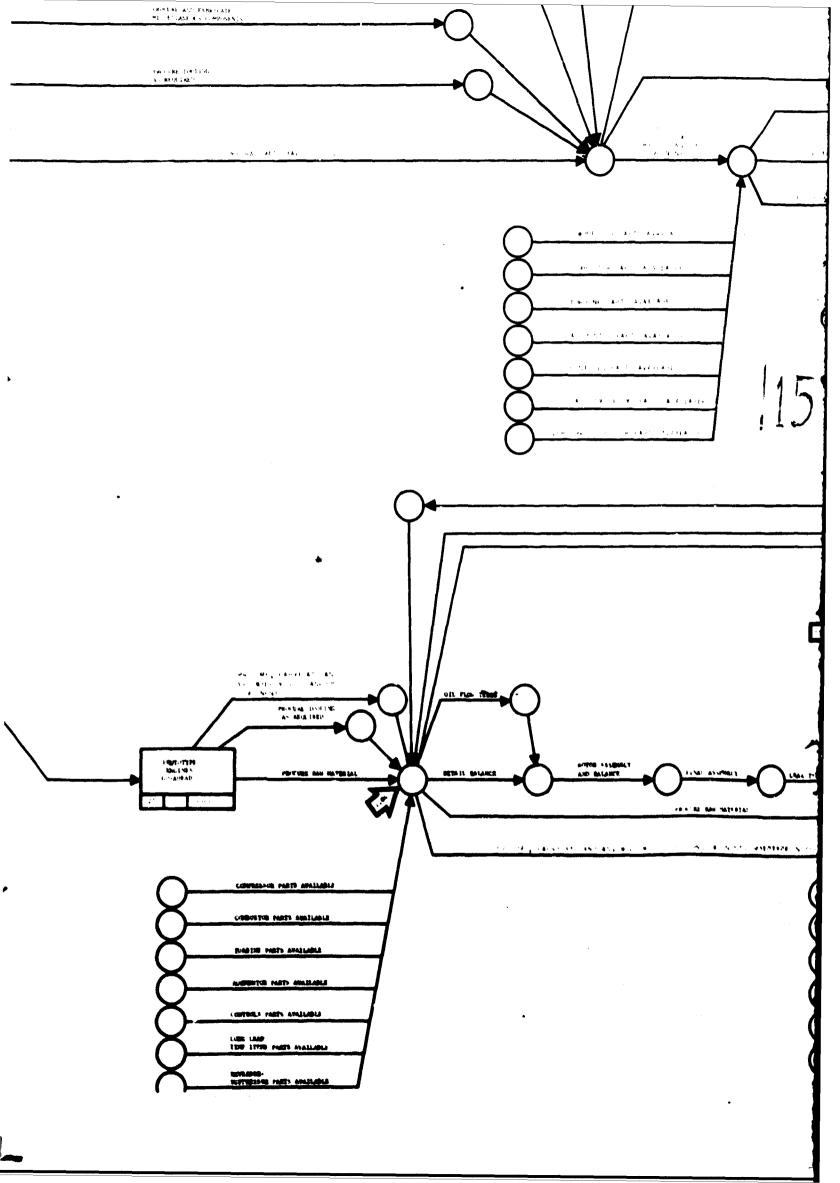
JAD one of Wealth College of the Approximate of the Approximation of the

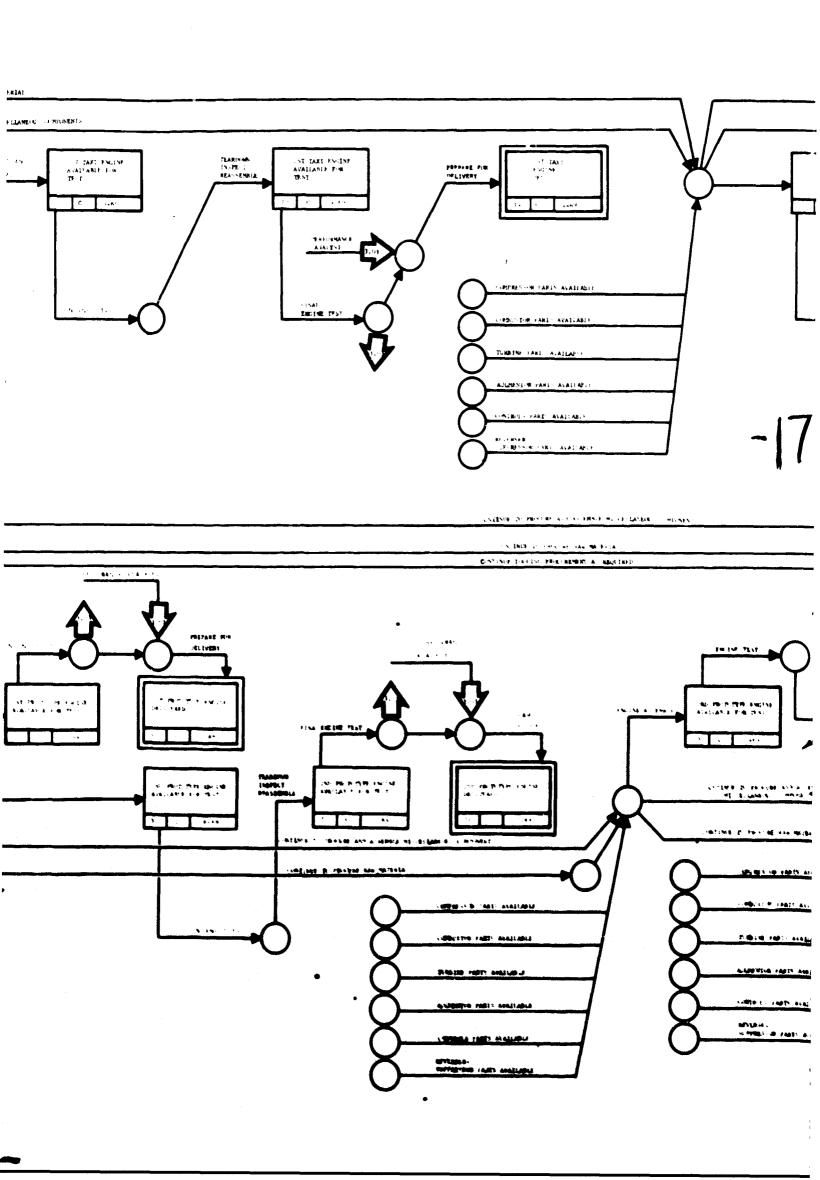
HENALUMMER 190 PRET AME MINUMEN

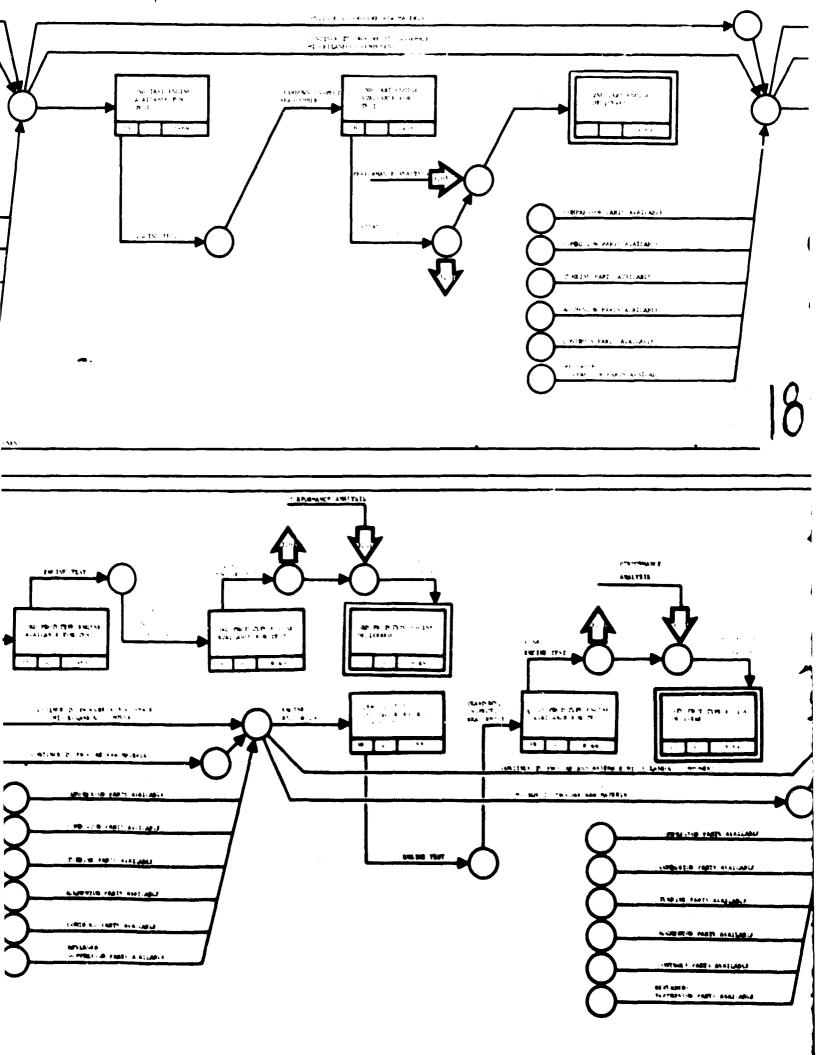
P80 P-044-W A

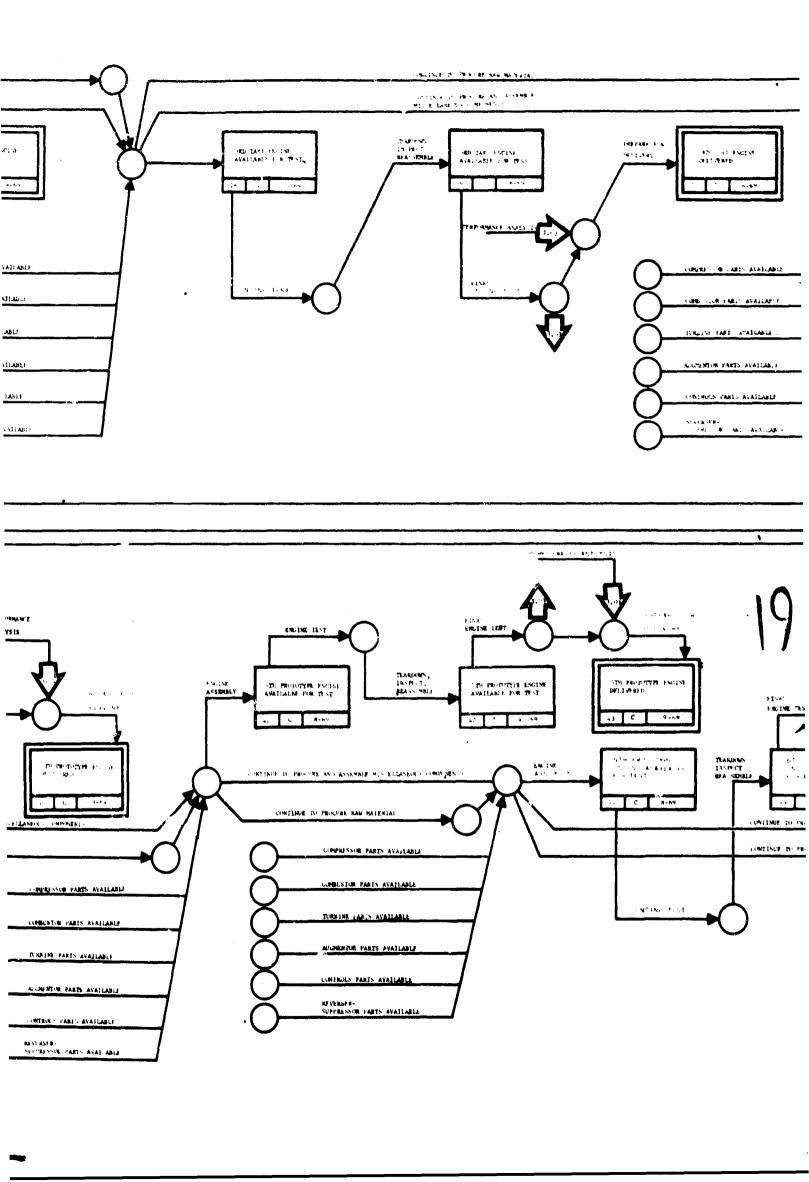
Figure 2.

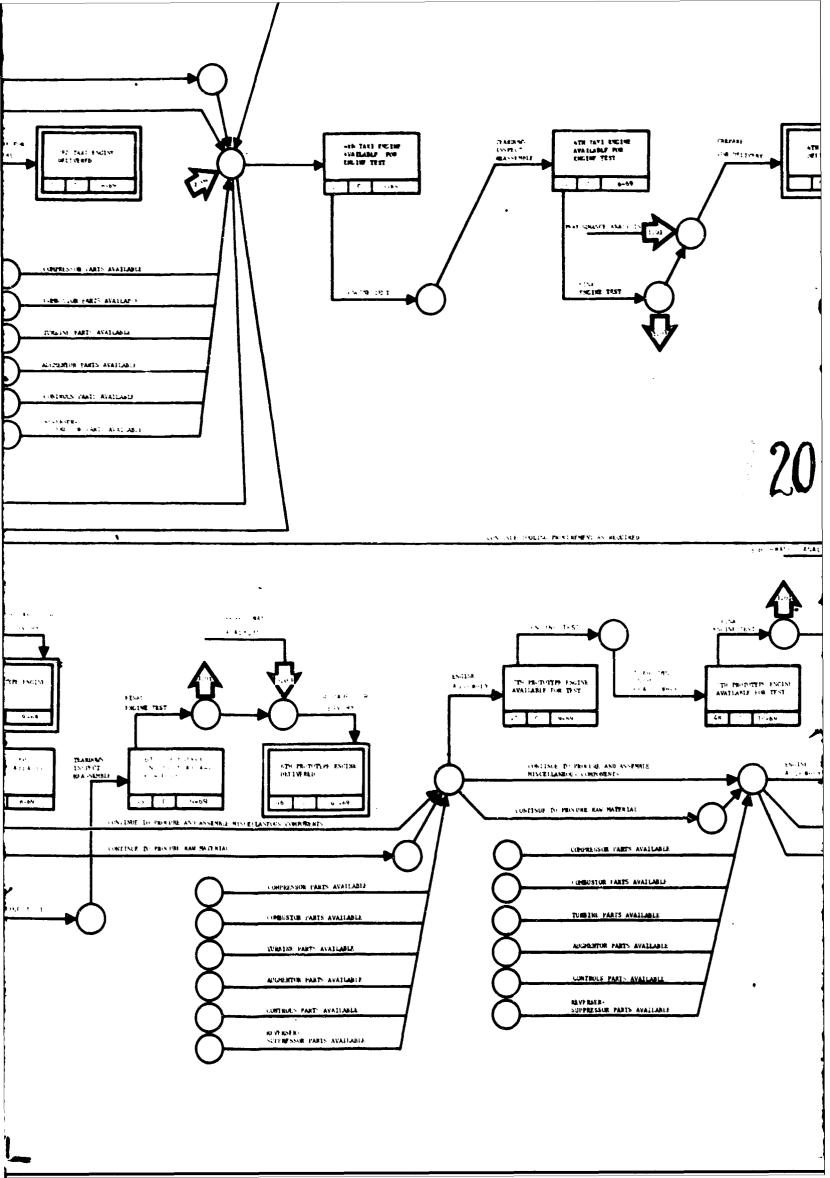


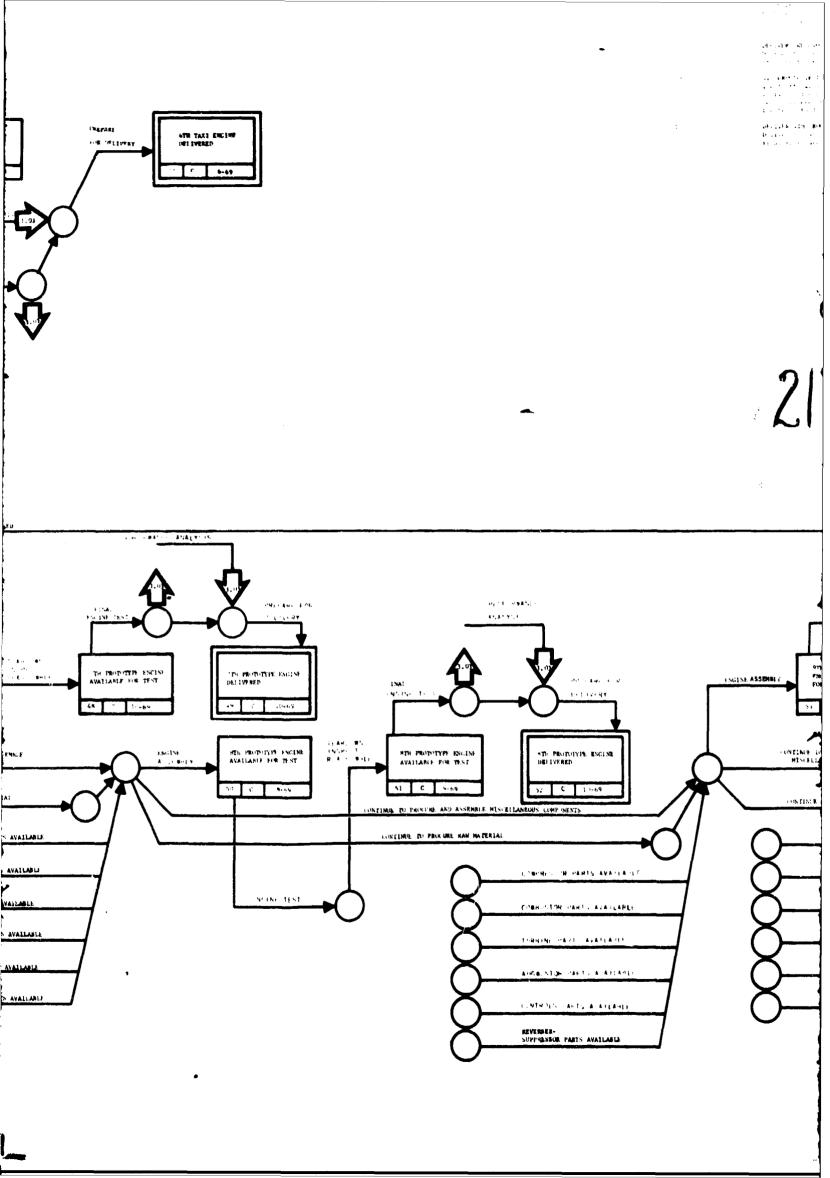












Provide the second of the seco

only the VIR CROCKED THEM A SOURCE TO COME CONTINUES TO COME CONTINUES TO CROCKED CONTINUES TO COMPANY OF THE COMPANY OF THE CONTINUES TO CONT

RD TAXA (Nepte Available FOR TEST). The first trap codes to exist to fined in the a packet of Disserve Content through a plate.

TRU (ANCE EDIGINE CONTRACTE AND ATTEMPT

ONE TAKE ENGINE DETIVERED BY A FOLLOW DESCRIPTION OF \$4. CO. FEED AND ADDRESS OF SEPTEMBERS OF SEPTE

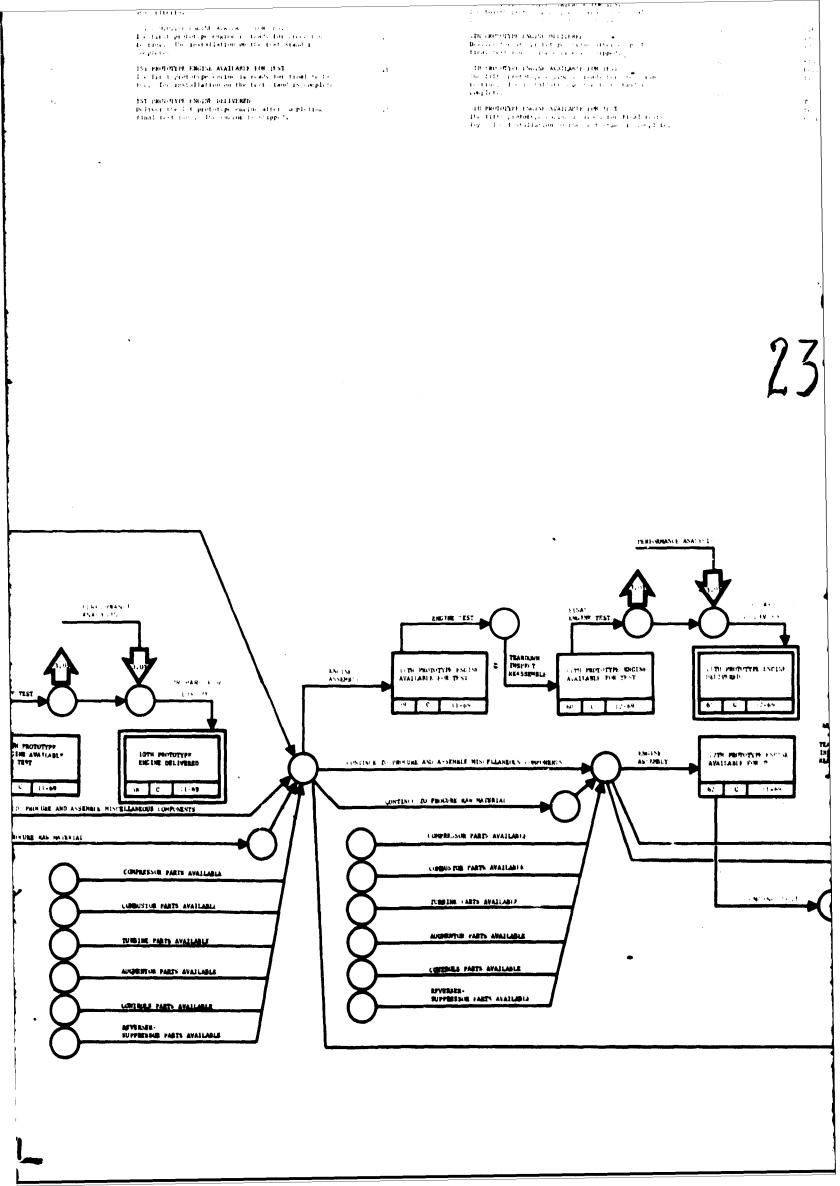
off JAAL EDGINE AVAILABLE FOR IP I. Profession to state the control of a control of the control

410 TAXI ENGINE WAITABLE FOR IEST De tearth taxi enview as mady for finel testion, De installation on the text stance assemblets PST PROG Deliver Final Is

1 - 11-1 1 - 11-1 1 - 11-1

154 PROTE

6) 66 (4844) Ana (4.3% ENGINE TEST 9TH PROTOTYPE THE PROTOTYPE MEINE AVAILABLE PROTINE AVATIABLE FOR TRET FNGINE ASSEMBLE ENLINF TEST 1-64 55 C TOTH PROTUTYPE
POR TEST 10TH PROTOTYPE ENGINE AWAILABLE POR TEST CONTINUE TO PROCURE AND ADSEMBLE MINISTELLANDON COMPONENTS 10TH PROT ENGINE ADDEMBLY CONCINUE DO PROCURE RAW MATERIAL CNITHIK IS PROCURE AND ASSENDED HISTELLA COMPRESSOR PARTS AVAILABLE CONTINUE IN PROCURE HAW HATSHELD CORBUSTOR PARTS AVAILABLE COMPRESSOR VA PHEINE TEST PURBLINE PARTS AVAILABLE COMMUNICAL PAR AUGMENTOR PARTS A, AVLABLE. TURNINE PARTS CONTROLS PARTS AVAILABLE A HERETE PAR ENVERSER-NUMBERSHOR HARTS AVAILABED CONTRACT PART MEVERNAR -SUPPRESING



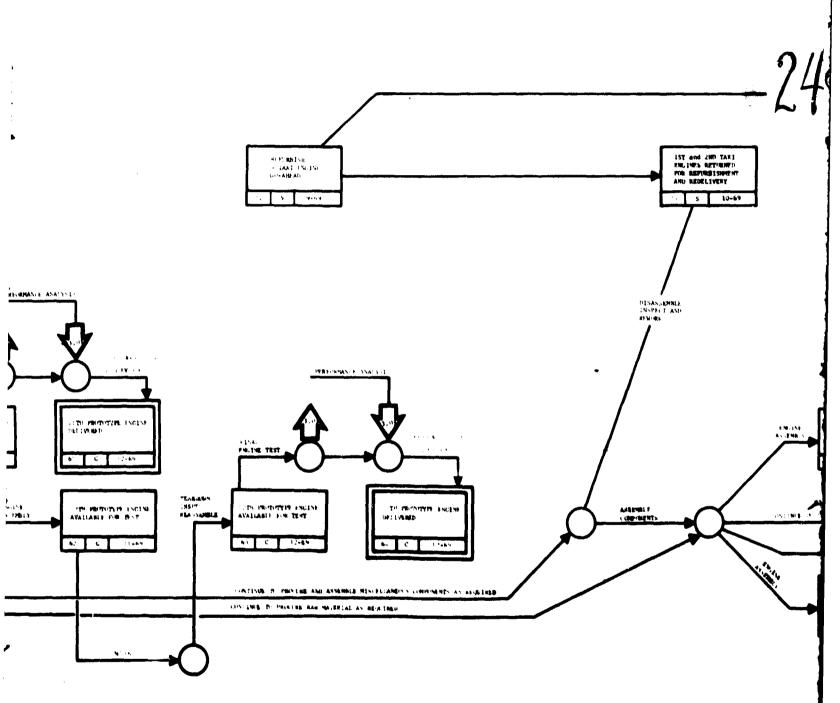
ear sections, fault from each employ to the formation of profit and a construction to the formation of the formation of the formation of profit formation of the formation of profits, formation for a formation of profits, formation to the formation of the format

The Controller English AVAIDABLE FOR LEVE IN The Controller Contro

THE HOTOGY I PE THE ANALYSIS FIG. THE SECOND THE SECOND

DIE (RUDDY) PRODE AVAILABLE FOR IS the tentile protetype could be transfer from the tentile for I in tentile we have to tentile complete.

1/TH PROTOTYPE ESCISE DELIVERED
Deliver to 1/14 or rates entre after completing rates to the me. It clears a few expects



COLUMN BUILT POLICE OF A MICHIGA

ignal to the

err err

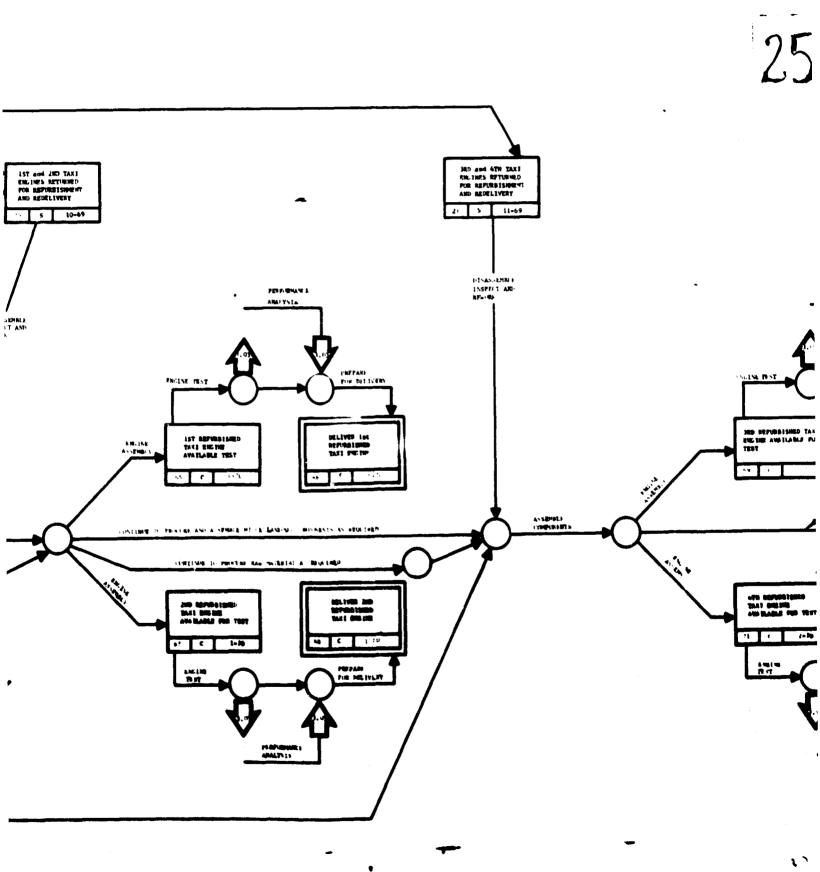
plottig

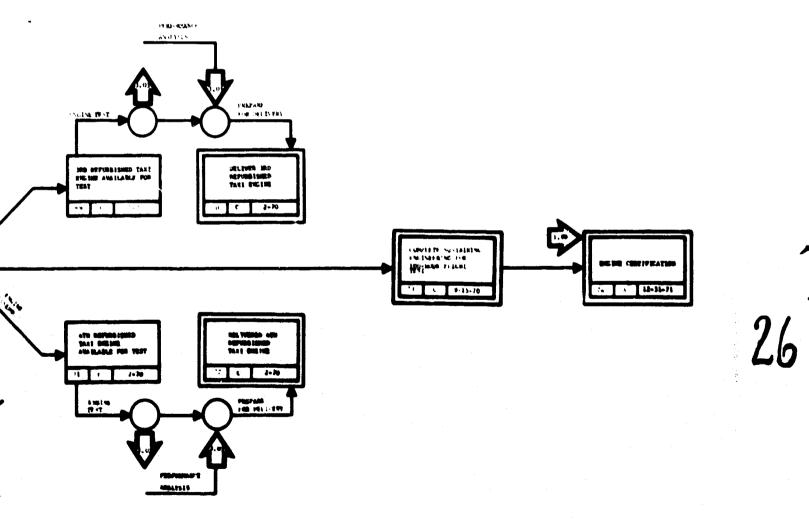
THE REPURNISHED TAPL INCIDE AVAILABLE FOR THE RESIDENCE OF the set that end for the protocopy configuration is complete and the column faces for text. It fallotten so the per tond is complete.

DELIVER THE MESURAISHED TAXI ENGINE. Believe the at roof of our relarishment to the protocology configuration (for completion final is through its time for bright to the left profotype engine. To engine in hipped.

COMPLETE SUSTAINING ENGINEERING FOR (DE-HACK HIGH TEST End of Phase HIT, Completion of 100 hour thick

fest program,





662908 FD 17843

PWA FP 66-100 Volume V

3.02 TOOLING

Special tools will be designed, procured, inspected and assembled in quantities to provide the capacity to meet the schedules of the JTF17 prototype and product support programs, described in detail in the Manufacturing Program, Volume V, Report G. As in Phase III development, the selection of the degree of tooling will be based on the maximum value in trade-off between labor costs and tooling costs.

The majority of in-house and subcontractor development tooling (70-80%) will be directly usable in the prototype and product support programs. This can be done since the development tooling will be gradually updated and modernized as design changes occur during the development phase. Maximum versatility will have been designed into the initial development tooling to handle the overlapping prototype, product support and continued development needs. This policy will apply to the new tooling necessary to meet prototype schedules.

Planning, as was performed during the development phase, will continue during the prototype program. All major assemblies and subassemblies will be analyzed during the layout stage. The experience gained during development will be invaluable not only to Planning and Manufacturing, but also as input to Design relative to producibility, which will stabilize the engine design and expedite final planning and tool design.

Process Engineering, which is responsible for specifying the special tools required by the manufacturing areas, is organized into groups that parallel the manufacturing areas of operation. This permits specialized effort and maximum application of experience. Special tools will be planned, designed, and ordered in the quantity to provide capacity to meet manufacturing schedules. Tool design and tool build will be scheduled to ensure that tooling will be available as required.

Most of the subcontractors utilized during the development phase will continue manufacture during the prototype and overhaul phase. In some cases additional or "hard" tooling must be added to supplement existing tooling for manufacture of JTF17 prototype and overhaul quantity of parts.

The major milestones, network chart and event dictionary for the prototype tooling rogram are shown in figures 3 and 4, respectively.

Pratt & Whitney Aircraft PWA FP 66-100 Volume V

FD 17890 VH

 1967
 1968
 1969
 1970
 1971
 ব্ৰব্ৰব্ৰ).02 TOOLING SCHEDULE 44 CONTROL SCHIPTING ENCINEERING FOR 190-40 FILENT TEST CHARLETE FABRICATION OF FIRST PROTOSTYR EXCENT PASTS NAMES ACTUBING FACILIFIES START PROPORTING TOOLEN. MINISTERIATION COMPLETE PROTOCOP ASSEMBLY TORNING WHEN PACILITIES MELINES FIRST PROSPERE ENCINE MELIVER SALT PROPORTYRE ENGINE OFFICER PIEST ENCINE PECTAL CERTIFICATION START PRESE 115 f min PACTA LITTLE S

Figure 3. 3.02 Tooling

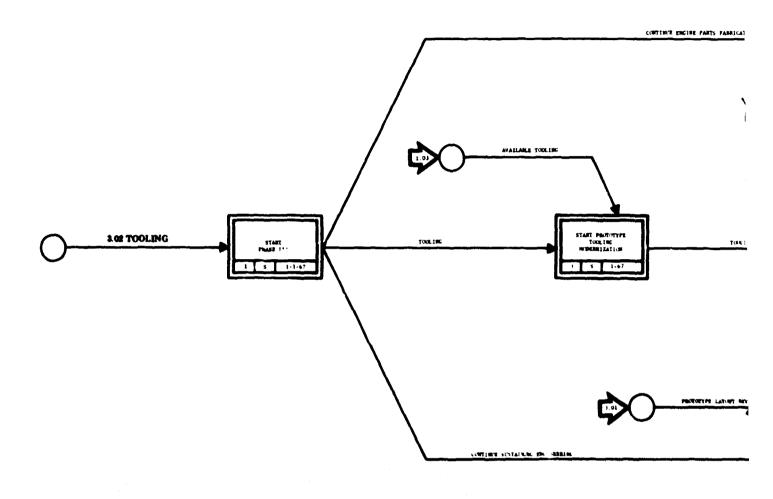
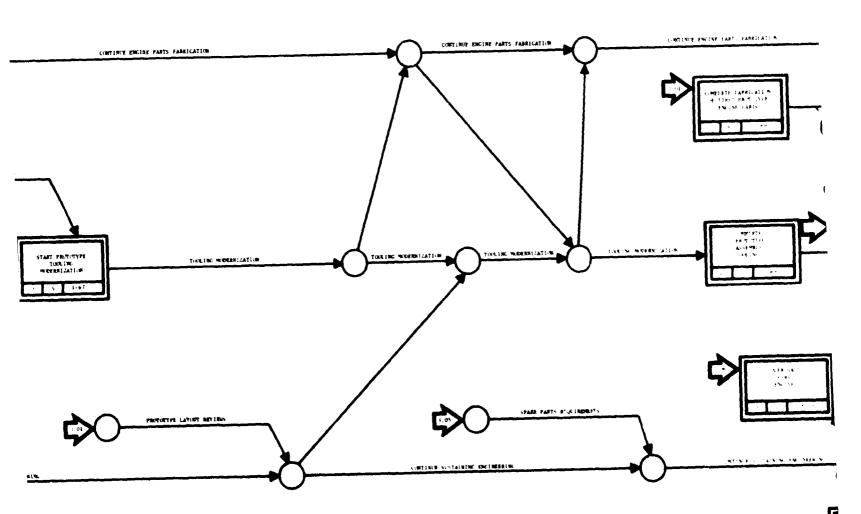


Figure 4. 3.02 Tooling

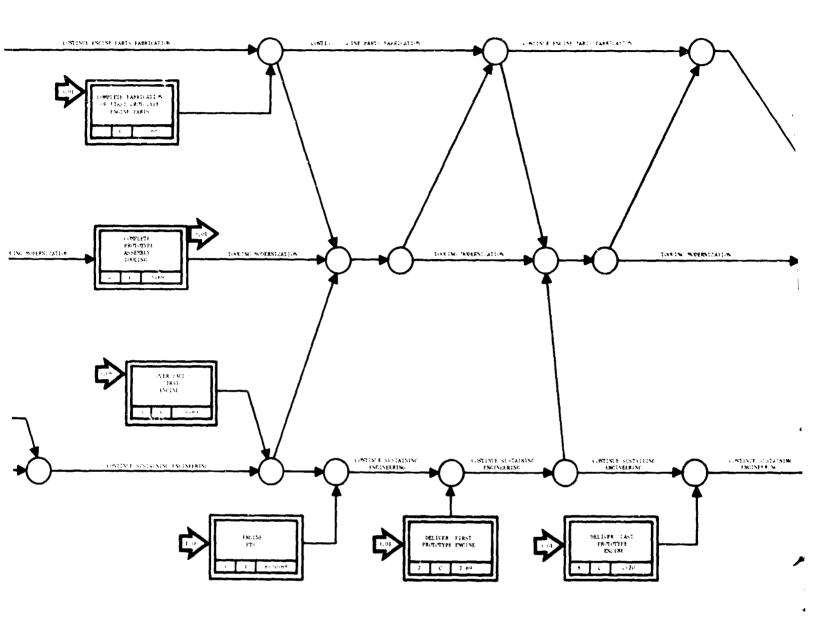
3.02 Tooling



* 1		**		·	5.5	-
	,		,		***	170

العروب وتريخ بست مستك فوداده با	Faces, Nove	Section 1.
TABLE COMMUNICATION OF PURPLE OF PROVIDER COMMUNICATION CO	•	See 14 Street Control of the Control
Application and the control of the c		ye (ME - Age) (A minus 1 f. f. e. M.) - The second of the
page relevante (本 1984 (本) (本) (本語 (本)		(a) Same provide the state of the same
Committee of the Commit	•	And the second s
Company of the Common of the C		Construction of the Constr

Tooling



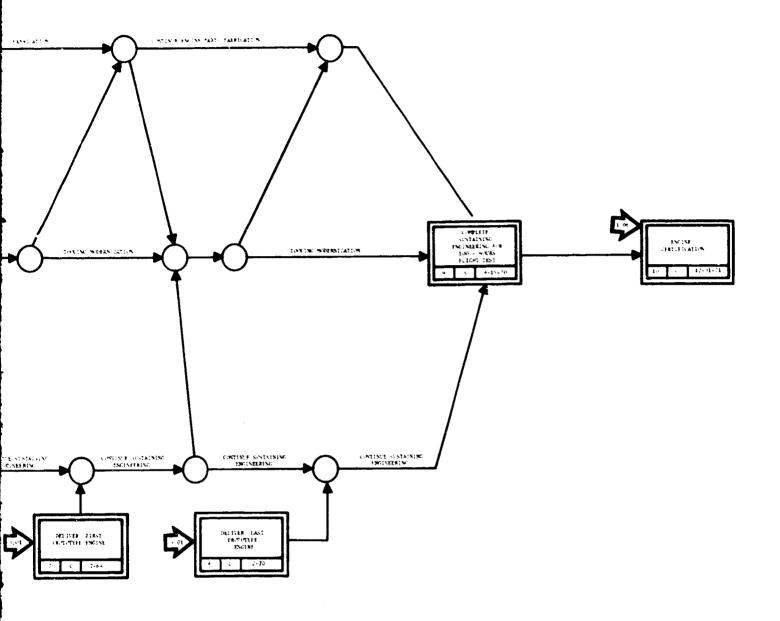
Description of Statesta

FNCSUSES
Reference of Charles Lord Description of Statestand Company (1997)

DETAILS FIRST PARKETS OF THE PARKETS

The office of the control of the processor of the parkets

proceedings of the control of



PWA FP 66-100 Volume V

3.03 ENGINE PERFORMANCE

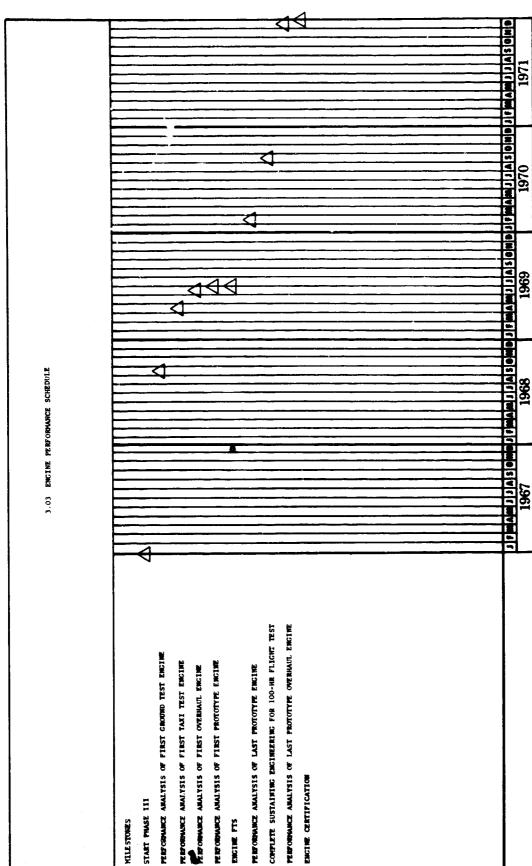
Performance analysis of the JTF17 ground, taxi, and flight test engines during Phase III will include reduction, processing and analysis of overall engine performance data with respect to thrust, specific fuel consumption, augmentation, efficiency distortion, cooling, heat rejection, starting characteristics and windmilling characteristics. Analysis and evaluation of inlet/engine/exhaust system compatibility and reverser performance are also an integral part of this effort. The performance effort also includes analysis and evaluation of the Acceptance Test data on new prototype and overhaul engines to ensure compliance to engine specification requirements.

The total performance analysis effort described in detail for development engines (Reference Section 1.07 of this Detail Work Plan) will be applied to the ground, taxi, and flight test engines. Test planning and integration of engine performance is presented in Test, Volume IV, Report E.

The major milestones, network chart and event dictionary for engine performance are shown in figures 5 and 6, respectively.

Pratt & Whitney Aircraft
PWA FP 66-100
Volume V

FD 17891 VH



3.03 Engine Performance Figure 5.

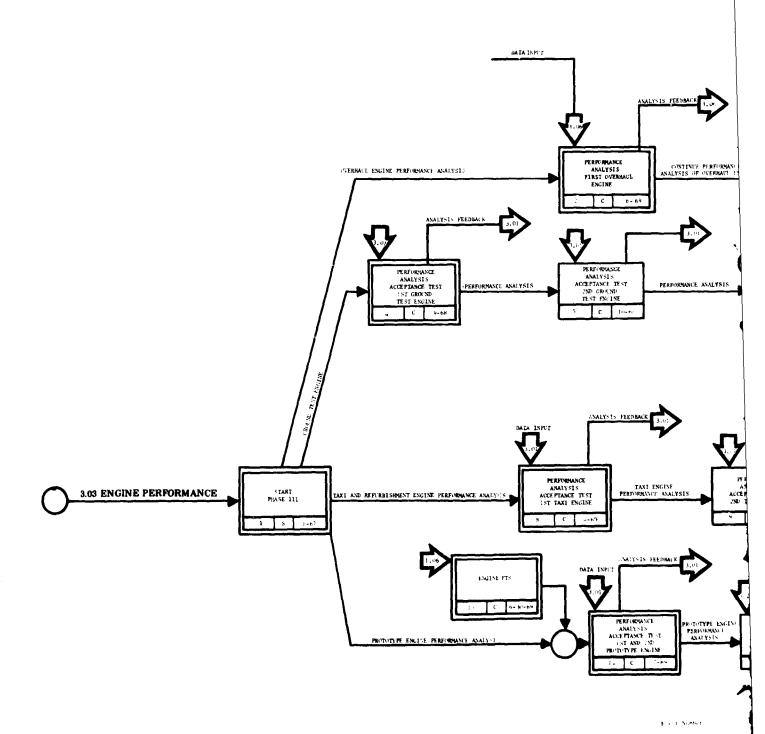
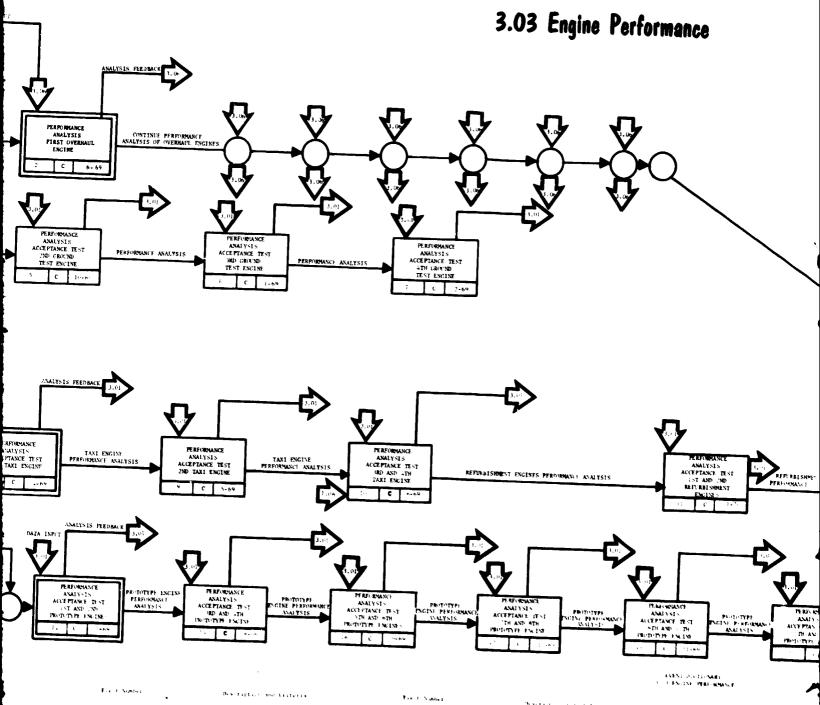


Figure 6. 3.03 Engine Performance



PERFORMANT MALESTON OF PERSTONNESSEED PROPERTY CONTROL TO PART PROPERTY OF THE STORY OF T

PERFORMANCE STATES OF GALE PROTECTIVE STREAMING FAMILY AND STATES OF GALE PROTECTIVE STREAMING FAMILY AND STREAM AND STRE

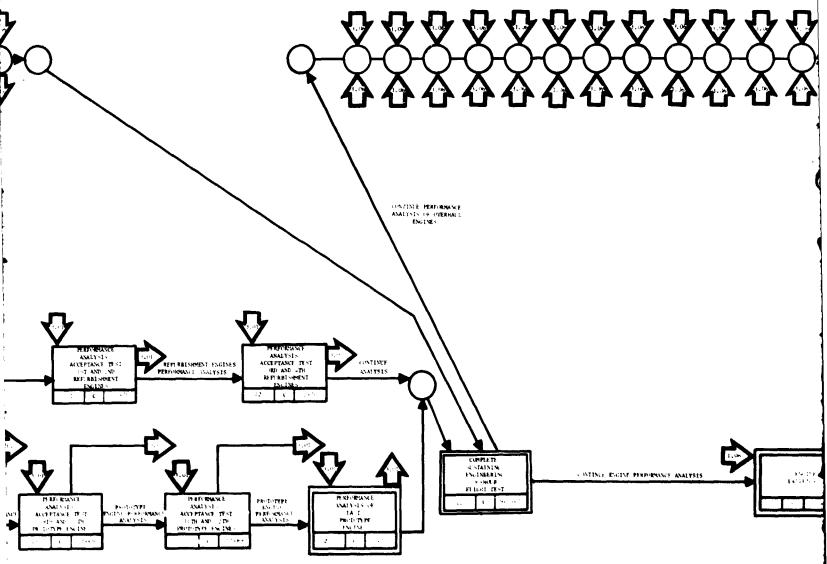
PRODUCT WALLS ACCREAGE THE EXECUTION OF THE PRODUCT OF THE PRODUCT

PRESENCE STATES ASSESSED BY TRANSPERSON TRANSPERSON ASSESSED BY THE PROPERTY OF THE PROPERTY O

PERSONNEL EXAMPLES WESTERNET CONC. PERSONNEL EXAMPLES DE LE PROCESE DE LE CONCESTO DE LA CONCESTO DE LE CONCESTO DE LA CONCESTO DEL CONCESTO DE LA CONCESTO DE LA CONCESTO DEL CONCESTO DE LA CONCESTO DEL CONCESTO DEL CONCESTO DEL CONCESTO DE LA CONCESTO DEL CONCESTO DE LA CONC

Merchanic C. C. C. Barray	R cos Number
PERFORMANCE AND A REPORT DESCRIPTION OF CHARLES AND CONTRACT OF CO	
ance few total reserve to proper grands the teacher that are seen	
PERSONANCE AND A ASSETTING TO SERVICE OF SERVICES	•
Compared to the action of the experience of the	
TENDORPHANCE ANALYSIS OF STREET BY THE STREET AND STREET BY THE STREET B	
the man on have engine a deposit one reaction to date.	
PERSONNANIE ANAINITE AUSTRIANIE DESTRUM ED ANT ELEREN TREE ENLINE	
A sign of the second section of the section of the second section of the	
PRESCRIPTOR ASACT SOCIETATING PROPERTY OF CONTROL OF CO	
to the control of the	

WEFFERENCE CASE TRAIN CORPORE CORRECTE CORPORE FERFURINANA ENLISE CORRECTOR ACADE N Parameters and a second Terminal vitations are some and are reco-



FUEND NOTE NAME.

		2 - v (1)	North C
۱۰.	5 4 2%		
	r .		
	4 :		4
	* *		

Object of March 2014 And Advanced Control of Control Co

And the second s

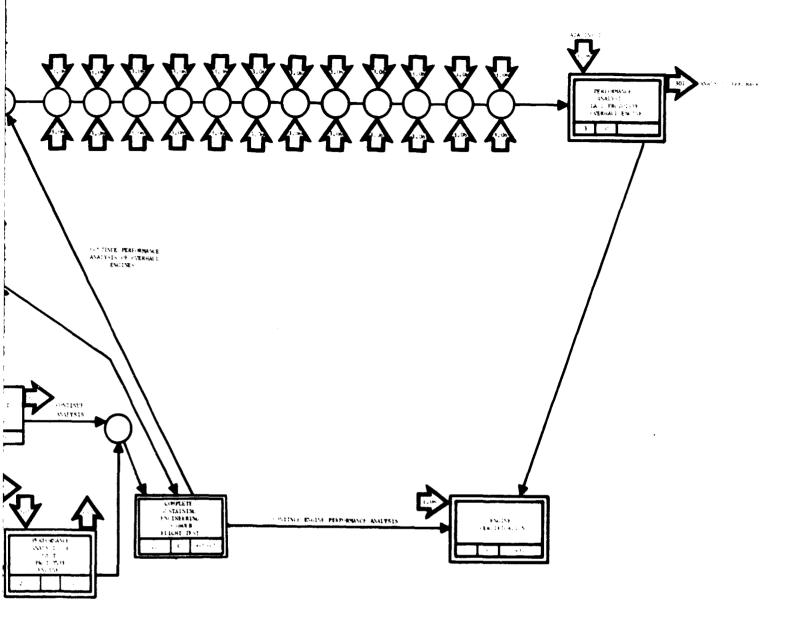
PRODUCTION OF STATE O

PROPERTY AND THE PROPERTY OF A STREET AND THE STREE

A second of the second of the

Support to control of the system of the control of

use the shall be set to be a substitute of the set of t



Note that the state of the stat

THE BRANCH ASSOCIATION OF THE BUILDINGS OF STREET

The second section of the second section of the second section of the second section of the second section sec

Transport for the same of the contract of the same of

AND AND CONTRACTOR OF THE STATE OF THE STATE

The second secon

ing the response of the respon

FD 17655 VII

3.04 ENGINE MOCKUP

During Phase III, the JTF17 engine program will require continued modification of the Phase II-C engineering mockups and engine installation mockups delivered to the airframe contractor. New mockups will be designed, fabricated and assembled to meet the requirements of a Class III installation design engine which will duplicate overall size, contour, external details of the actual engine design within manufacturing tolerances. Class II engine installation mockups will be fabricated and assembled for The Boeing Company's requirements only to provide overall size and contour, but the extent of completeness and the tolerance control will be accomplished to a lesser degree. This program will provide the airframe manufacturer with the most useful and complete engine installation mockup so that a full-scale, three-dimensional conception of the engine exterior configurations is obtained. Practical solutions of general configuration details covering operational suitability, reliability, safety, accessibility, and maintainability will be obtained throughout the design and development of the engine installation.

The design and construction of the engineering and installation mockups will conform to general procedures of ANA Bulletin 406-A, including identification of pertinent parts and sections of the engine and color coding of components and accessories. The engine mockups will be constructed of metal and fiberglass-reinforced plastics with the use of hardwood limited to Class II engine mockups only. The engine-airframe interface boundary will be highlighted by color code and servicing points.

The major milestones, network chart and event dictionary for the engine mockup program are shown in figures 7 and 8, respectively.

A detailed description of the engine mockup program is presented in the Mockup Plan, Volume III, Report D, Section I. Test planning and integration of engine mockup is presented in Test, Volume IV, Report E.

PWA FP 66-100 Volume V

> FD 17892 VH

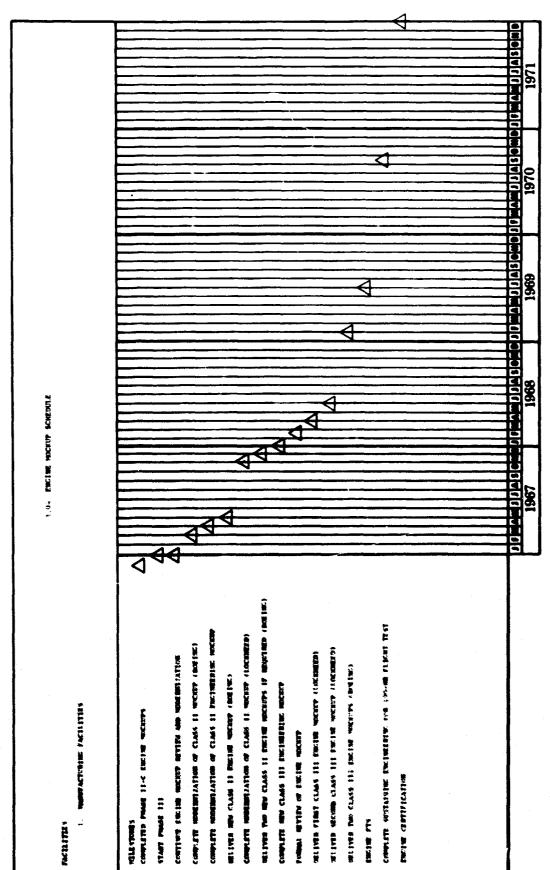
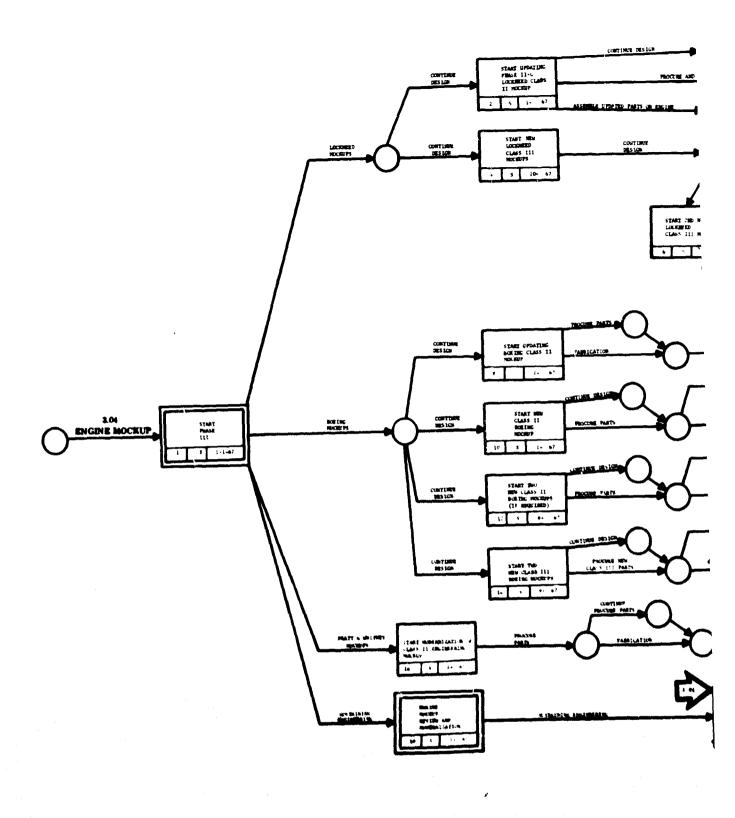


Figure 7. 3.04 Engine Mockup



Specifical Specifical

Comment of the Commen

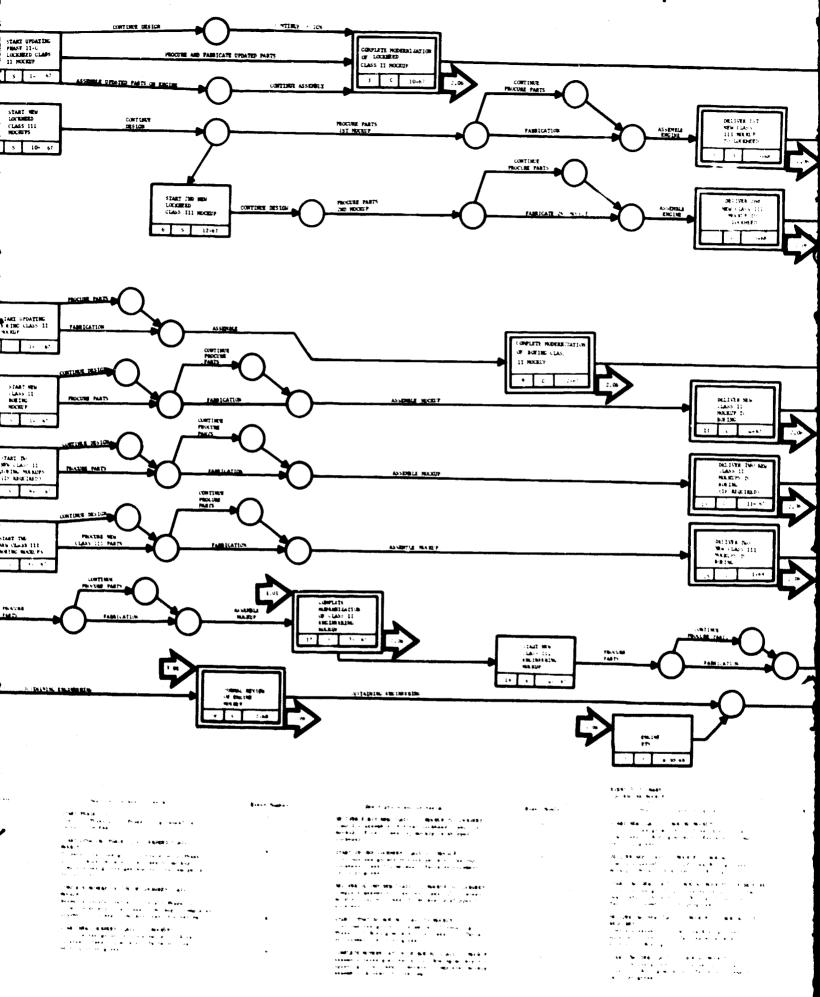
We get a server of the server

Separate expensions of the expension of

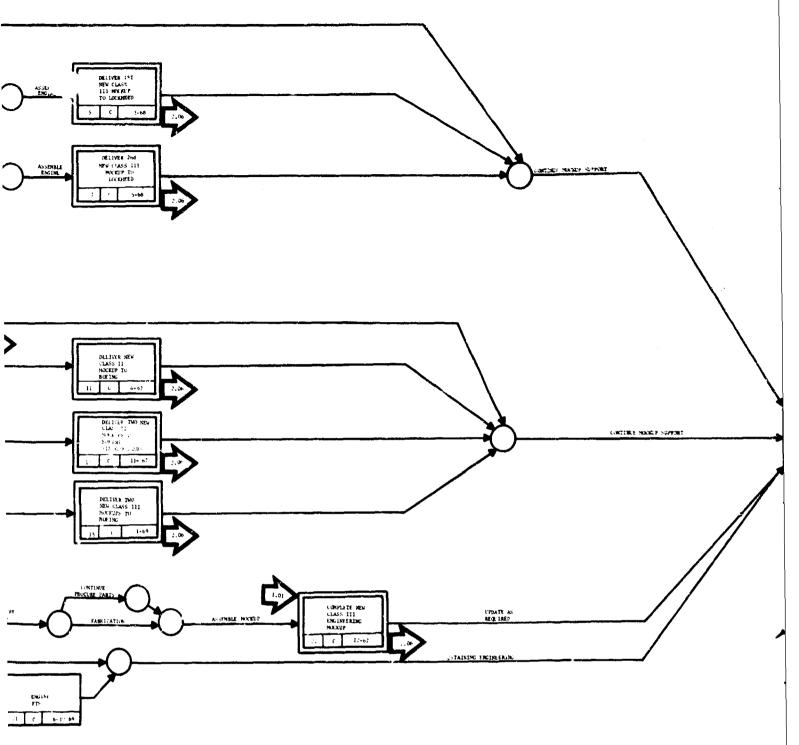
Chapter with the market was a second of the second of the

Figure 8. 3.04 Engine Mockup

3.04 Mockups

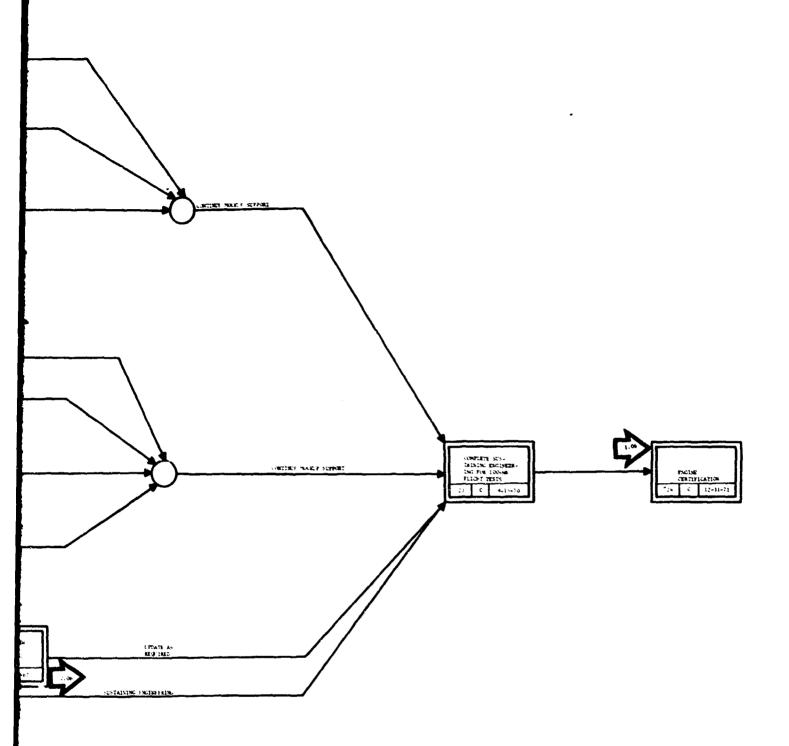


Aockups



TENT DICTIONARY NO ENGINE HORKUP

processor to a statement	Event Number	Description and Criteria	Event Number	Description and statetics
AR. NEW CLASS OF BEHIND WESTER Offices besign and process parts for forest workers of Research mostup. Errors processment	4.9	DELIVER TWO NEW CLASS III NO SCPS TO BUTTING Complete assembly of one new class III mediums Two Class III mediums are shapped to Booking.	24	PORMAL REVIEW OF ENGINE MARKETS CONTROL CONTROL OF TEXAS AND ADDRESS OF TEXAS. WHAT CONTROL OF TEXAS AND ADDRESS OF TEXAS.
TIVER NEW CLASS II MEACH IN PRINC By the Second of Continue Bring Cont.	**	START MODERNIZATION OF CLASS II ENGINEERING MARKEP Continue design and provide parts to converting Phase the Engineering No kep to a class II no kep. Parts Procedemant is in Process.	24	EMANG ATS Reference engage network (i.e. the description) and craffered
(iii) Microphysics of approximations. ART The New York of Towns (1) The DNA NEW AIR RESPONSED CONTRACT OF A DATE of the Contract of		COMPLETE MODERNICATION OF CLASS IT ENGINEERING MANAGED ASSEMBLE CLASS IT Engineering monkeys, complete.	23	COMPLETE NEW CLASS ALL PROINTERING MARKET Assertion Plane 112 Eigenstating with the communication assertion of Courts and Tende Latitudes.
The processor is near grass. 13888 the SM stars it wester is to behave it.		ENGINE MARKET REVIEW AND MADERNESSTICS	21	COMPLETE SPORENCIAL ENGINEERING FOR LODGE S FOUND TEST FACT FROM (11 Complete of the Course of
October 10 to the control of the con		Houses because the management of the class of message of composite the review of the class of th		into testing Course centification
ART THE ARM FLASS (1) REPOSE MAINTEN OFFICE STANKE OF THE STANKE TO THE		e ntrain design and produce parts the class ill moreon. Parts programment is no programs.		Reference anguise censure à 36 tou description annoulesterial
see (i) him of more Profession than it. Considers				



of street	ert Simber	Description and systemia
SKE DO TO BORTON - Controlling Control - Controlling Control	56	FIGURE OF ENGINE WORLD CONTROL OF STREET CONTROL OF THE CONTROL OF STREET CONTROL OF
1. SN UNFERING MORES CHIEF TO CHIEF CHIEF SOURS II		MADNE FR. Beterrore supplies to book as a few description and cristerial
TO ENCINERING	••	OPERTY STWOODS AND ENGINEERING THE STP ASSUMBLE PLANS 100 Progressing Sections, a specific assumption of market sections.
en e		C MPD 15 SESTAINED ENGINEERING FOR COURSES FROM TWO TO THE SESTAIN FOR COMMON OF THE SESTAIN FOR THE SESSAIN FOR THE SESSAIN F
A NO MARKET - The fore reserving - The grant		AND SERVICE CATION. Reference of any order in 1 on for description and other categories.

FD 17810 VH

PWA FP 66-100 Volume V

3.05 SPARES

Selection of spare parts for the JTF17 engine will be based on the judgment and experience of well-qualified personnel having a broad background of knowledge in the areas of maintenance and overhaul of Pratt & Whitney Aircraft engines in current commercial operation and in total support of the J58 Mach 3 engine. The spare parts effort to support the JTF17 engine and the plan for post sales spares support is described in detail in Product Support, Volume IV, Report F, Section VI.

Experience gained during development testing of the JTF17 engine will be utilized to the fullest extent in establishing quantitative spares requirements. All parts selected as spares will be incorporated into a computer-oriented data file which will be continuously updated to reflect the effects of Engineering Change activity.

Approximately 60 days prior to release for manufacture of the prototype JTF17 engines, a spares support list will be prepared by data extraction methods from the computer storage file. In the extraction process a computation of quantitative requirements for JTF17 maintenance and overhaul support will be made and the resulting product will be identified as a Recommended Spare Parts List. This list will be released after review for procurement and delivery at a rate commensurate with delivery of the prototype engines. Procurement or fabrication, inspection and shipment of all spares will be the basic responsibility of the Delivery Material Control Department together with all ancillary departments.

A facility will be established at the flight test site for the purpose of receiving, warehousing and disbursing maintenance spares and to handle the return of repairable items to the FRDC overhaul facility and/or to vendor overhaul facilities. Spare parts representatives will be assigned to man this activity and the maintenance spares inventory will be reviewed and analyzed daily to assure that it will adequately support the flight and ground test programs at the maintenance level. Similarly, the FRDC overhaul and vendor overhaul facilities will include segregated areas to receive, warehouse and disburse all parts required for support of overhaul and repair jobs performed during the prototype engine program.

A computer-oriented data collection and storage system will also be used to summarize all pertinent history relating to the ordering, shipment, usage and inventory balances and values on all parts procured, delivered or on order for support of the prototype engine program. Coincident with this information, a computer-oriented Spare Parts Application Data List will also be compiled and maintained, which will reflect the engineering history and progression of all spare parts applicable to the JTF17 engine.

Spare parts will be scheduled to be available at the ground, flight test and overhaul activities one month prior to commencement of engine operation at each location.

3.06 OVERHAUL

JTF17 engine overhauls required during the ground and flight test programs will be accomplished at the Florida Research and Development Center. The overhaul processes of disassembly, inspection, repair, updating, assembly, and test will be performed by the Engine Delivery Group.

The FRDC overhaul and vendor overhaul facilities will include segregated areas to receive, warehouse and disburse all parts required for the support of engine overhaul during the prototype engine program. By conducting overhauls at our facility, personnel from Project Engineering, Design, Reliability, Maintainability, Human Engineering and other affected groups will be able to observe engine parts condition and overhaul practices and initiate corrective Engineering Change action and/or procedural changes where required.

Detailed reports of engine condition and spare parts usage for each overhaul will be provided.

Technical direction, including extent of disassembly and repair, Engineering Changes to be incorporated, testing to be performed, etc., will be provided, as well as continual monitoring of engines in the over-haul process to avoid delays by anticipating and expediting parts requirements.

The Overhaul Manual will be used during this activity, thereby permitting an evaluation of its various sections throughout Phases III and IV and ensuring a complete and detailed manual for airline operation. In like manner, overhaul tooling will be continually reviewed and will guide the Service Tools and Equipment Group in its final designs of airline overhaul equipment requirements.

The schedule for overhauling engines during the ground test and flight test program of Phase III is as follows:

Engine No.	Overhaul Schedule Completion Date
1	June 1969
2	November 1969
3	January 1970
4	March 1970
5	May 1970
6	June 1970
7	August 1970

The major milestones, network chart and event dictionary for the engine overhaul program are shown in figures 9 and 10, respectively.

A detailed description of the overhaul program is presented in Product Support, Volume IV, Report F, Section VI.

PWA FP 66-100 Volume V

> FD 17893 VH

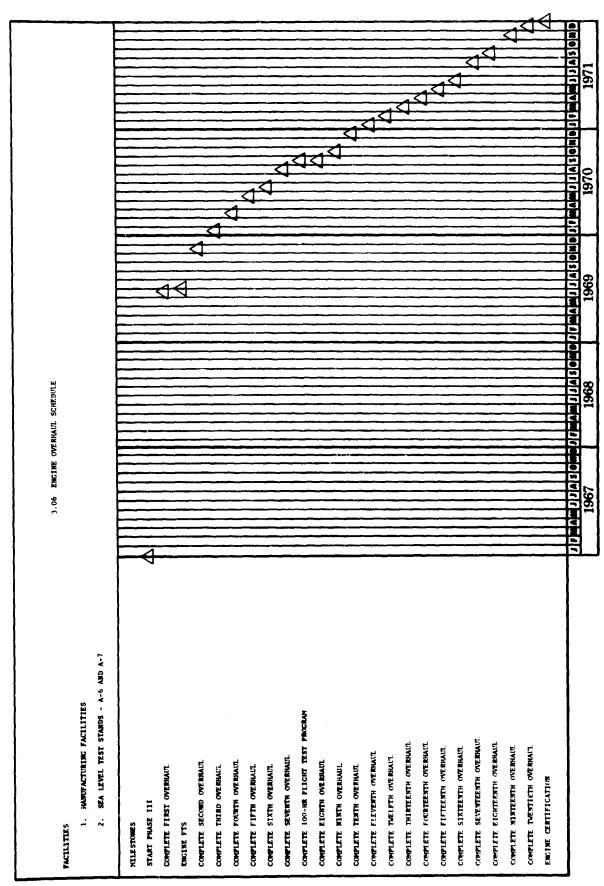
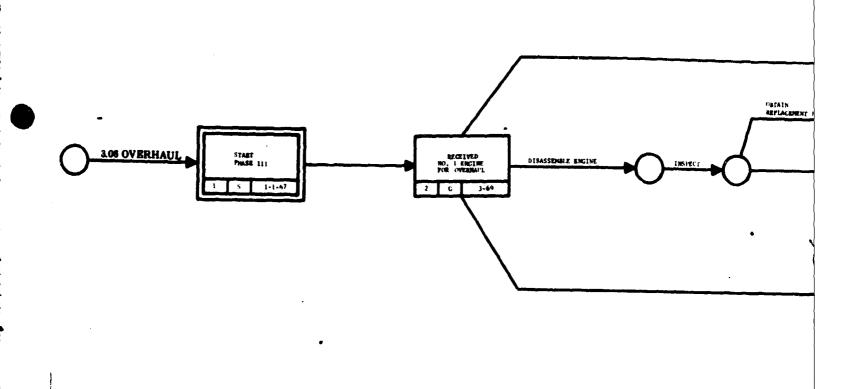
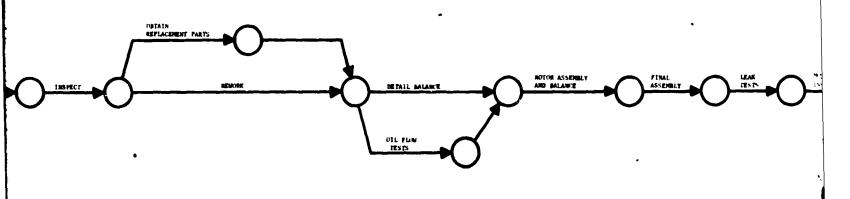
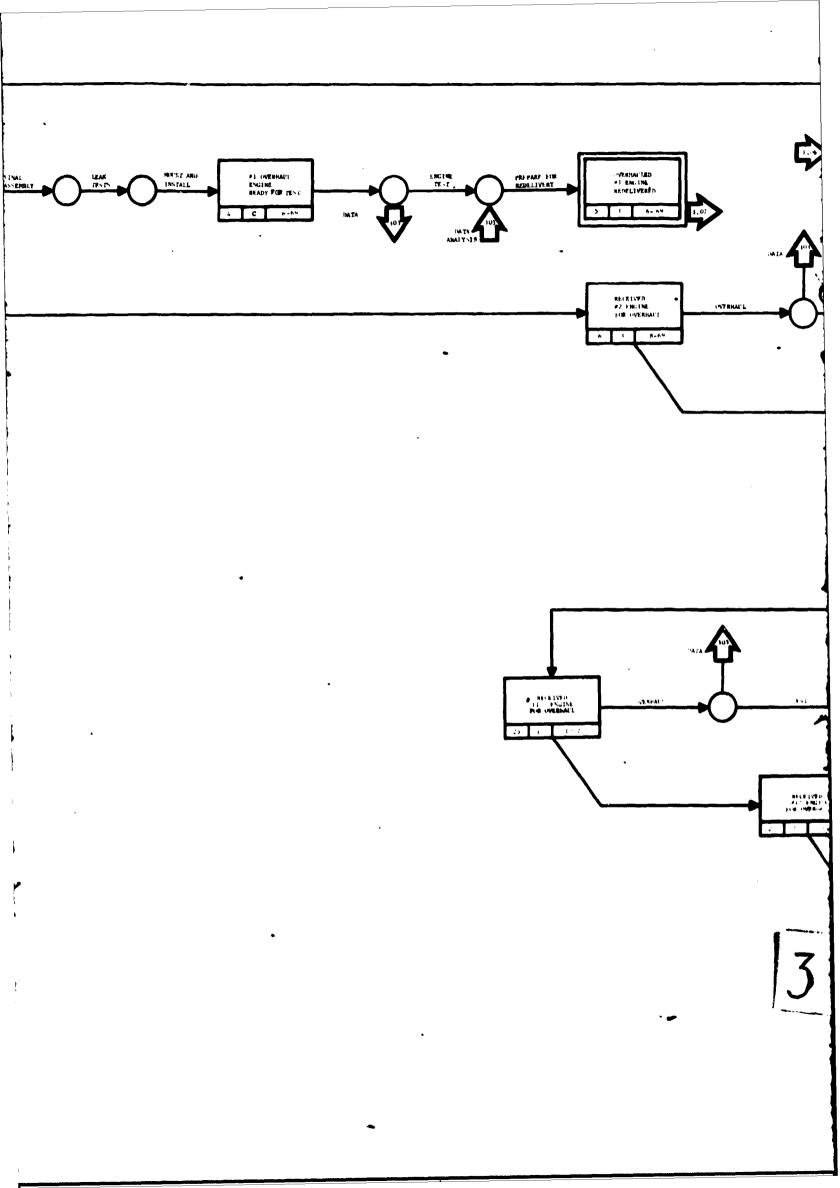


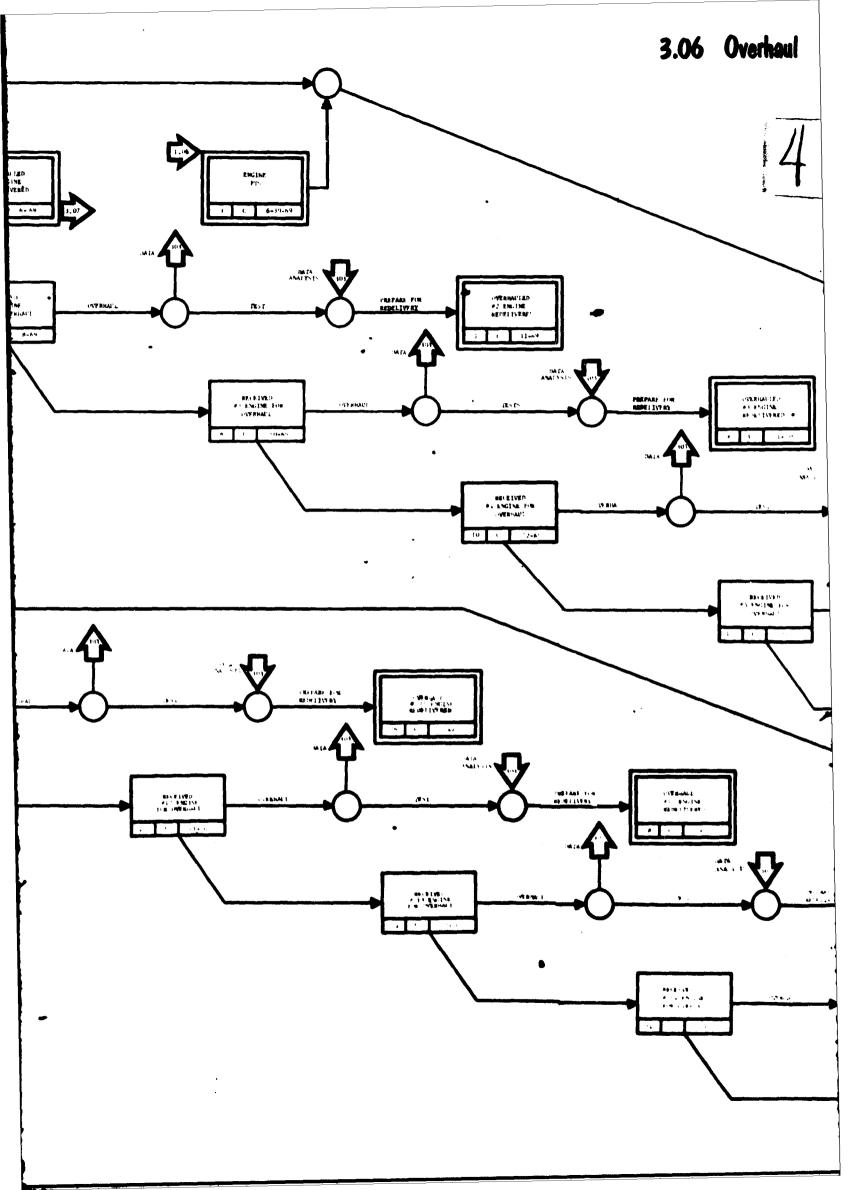
Figure 9. 3.06 Overhaul

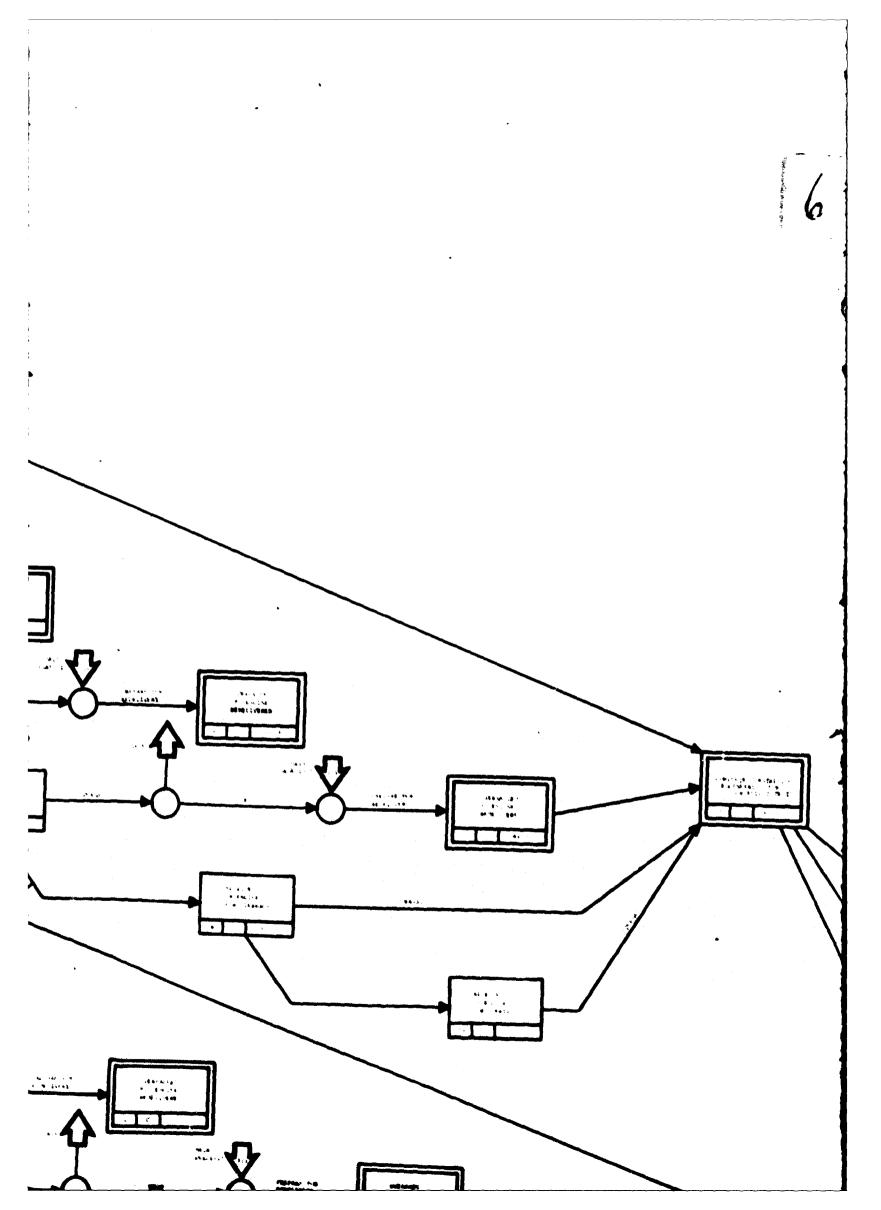




2







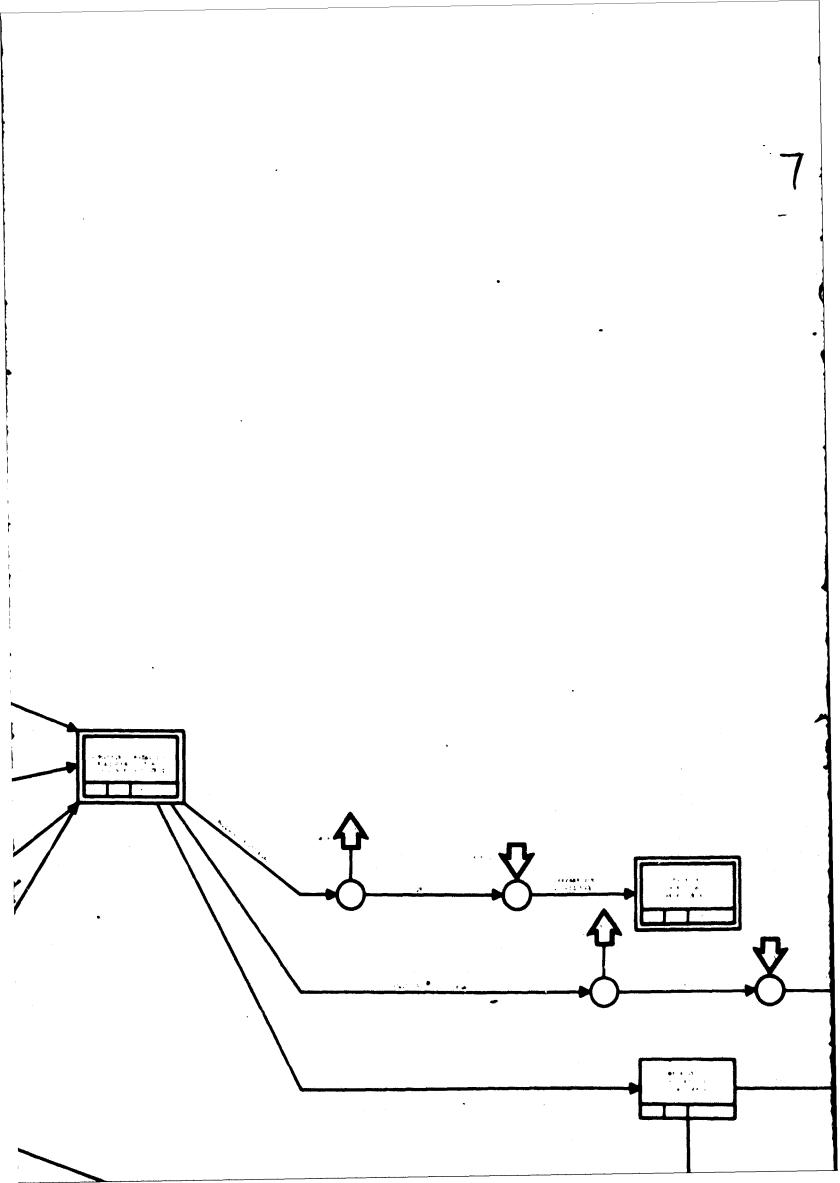
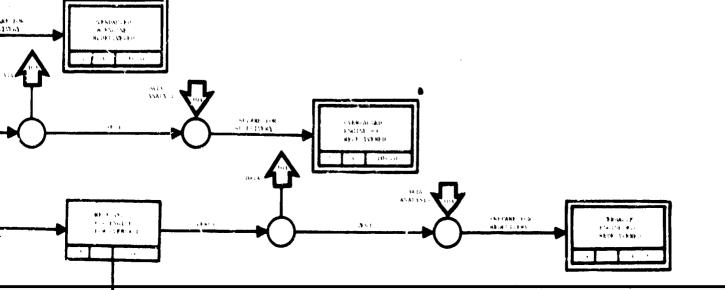
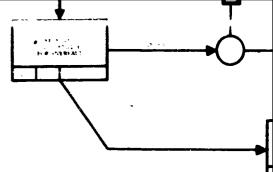


Figure 10.





description of contraction	1. 1. 4.7.4
Cost Over 121 Cost of Power 12 - Brown Marketon Conserva- age 1850	
RECORDS OF ENGLAND FOR COPPOSED Notice of the conduction of the c	·
SMADLERS Reference of \$100 of the London Secreption and crystation	٠
CROOMS ENGINE MEAN FOR THE SPECIAL PROPERTY OF THE SPE	
CONTROL Of TWO MEMORY IS NOT SERVED OF SERVED OF THE CONTROL OF SERVED OF SE	, 4 4
RECTARD 6 195-195 FOR SCHROLL Rectard of the general controlled the obstacles consecutive to the control of the control of the consecu- tive techniques of the control of the consecutive control of the contro	
OCCREATE # ESSENCE BEAUTISTS So do record the moneyal so certained search consists so record to School one	.4•
RESTINATE CONTINUES OF CONBINET Restinated the same of contract to Dissertion as command to the second of the sec	
CANCILLE STATES OF THE SECTION OF TH	.41
MECHANICAL PROPERTY OF CONTRACTOR AND ACCOUNTS OF THE ACCOUNT OF THE ACCOUNTS	
CONTRACT TO TRACTOR OF BOTH AND	

Programme of the control of the cont

APPLICATION OF STAIR AS READERS AND APPLICATION OF STAIR AS I READ AS A STAIR AS A STAIR

OVERORITOR ESCIPE RESPUESMED.

RESPUESMENT SCIPE CONTROL OF A CONTROL

REFERENCE FOR THOMPERS AND RECOGNIZED AND THE CONTROL OF THE CONTR

TAMESIAN LOS ENCINE MEDITERRED BROKERS OF COMMENT OF A CO

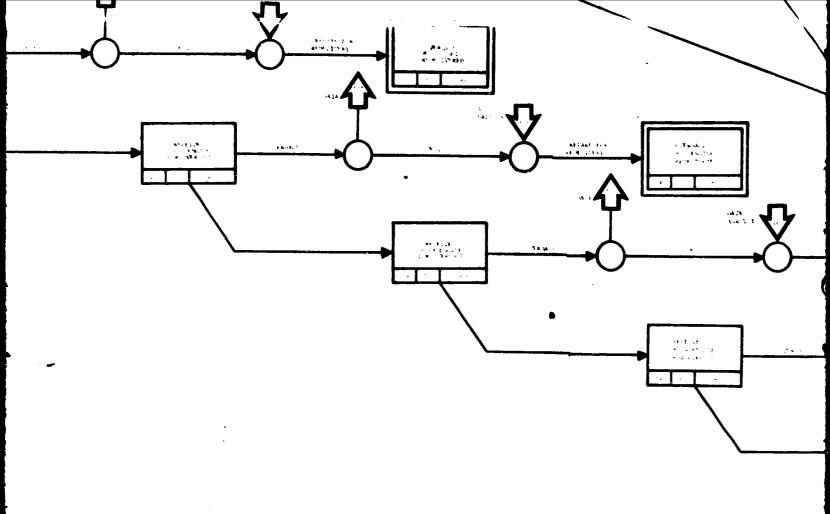
RECEIVED AS ESCINE TOS CERBRAL.
Received A Sergion of the velocide. Become on a received with the first opening contained and decreases to the deliberation.

NEXT CONTROL OF THE OFFICE OF THE PROPERTY OF

COMPACT SPEAKING PROMITED AND SECURIOR SPEKERS AND SECURIOR SPEKERS AND SECURIOR SPECIAL SPECI

STANDARD SKIPAGASE BEDEVLAVEN STANDARD SKIPAGASE SKIPAGA

where the probability of the pr



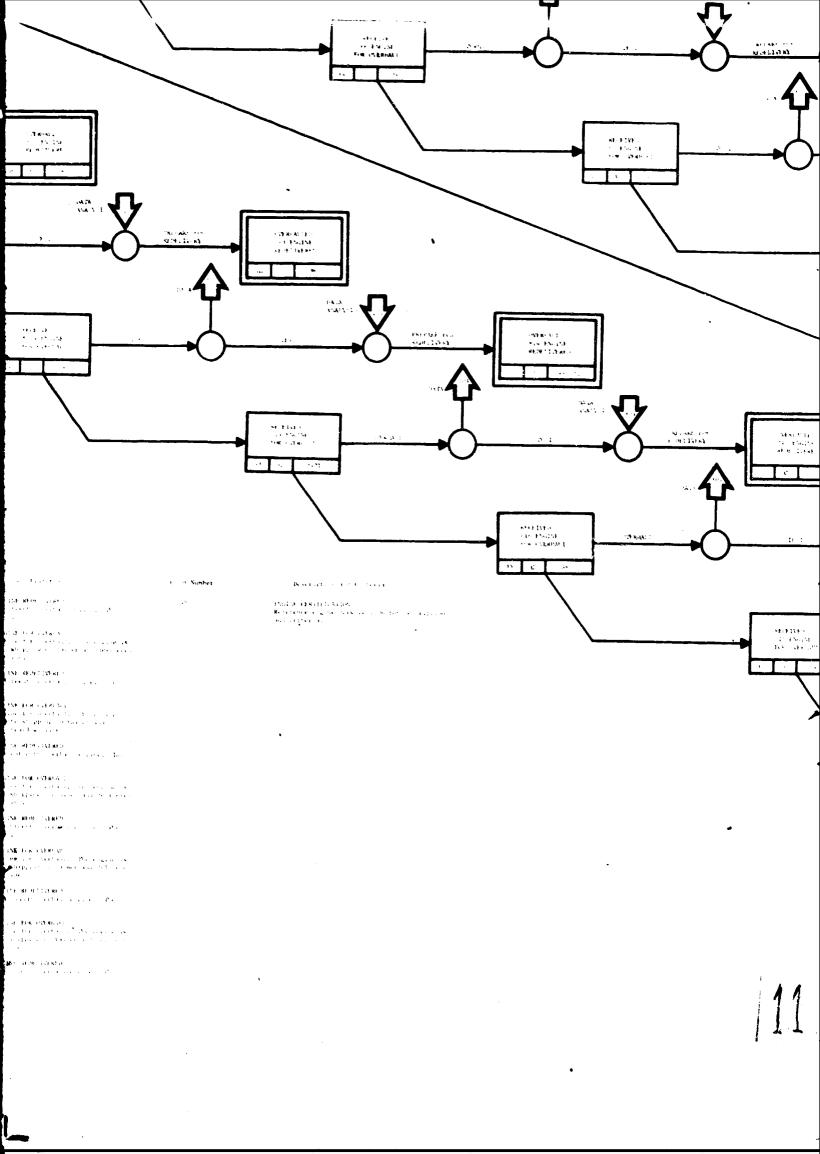
٠	vi.	;	an	TIPLANT

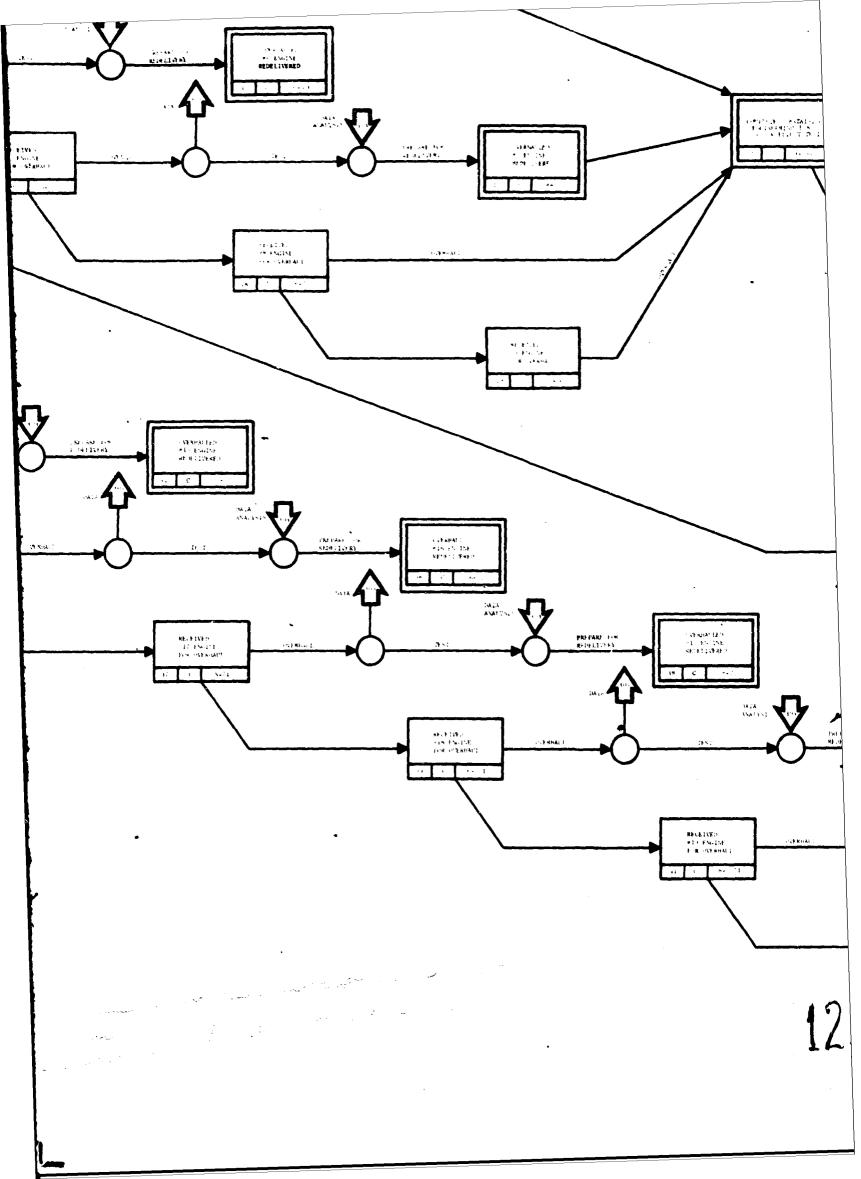
- ONE ROAL I

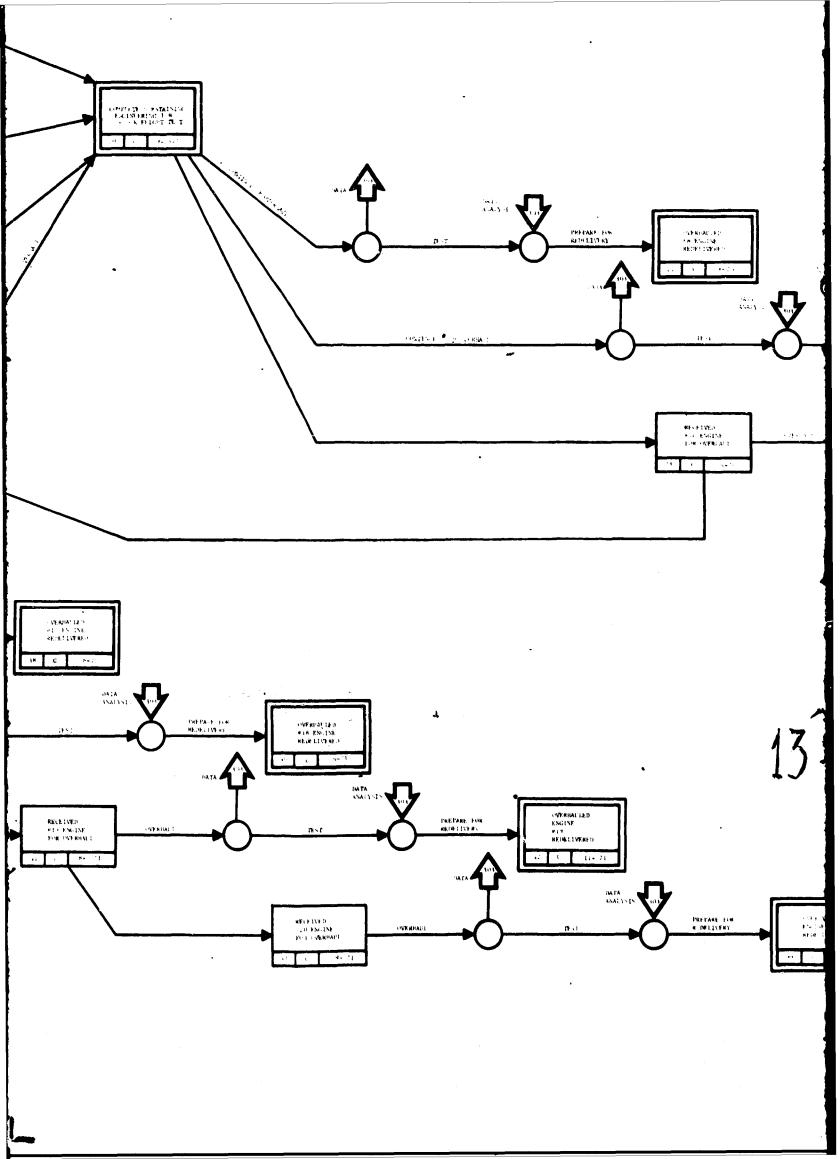
the all options of the characters of

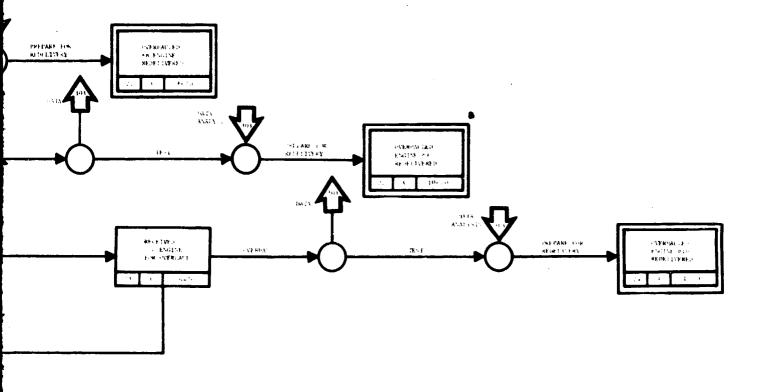
on a State of the control of the con		SENSIFIED BY AND SENSIFIED AND	V	MORENT CONTROL STREET RESERVED TO CONTROL STREET
Here C. (140) Grant C. Grant C.		SCHEMING OF STANDARD WITHOUTERS # 15 conditions to the constraint of the constraint SS SOCIETY	1.	Mark LABO in the product form of the product of
Stork CERCACI Consists of Consists of Consists Space of the Consists of Security the		MEXICOD on the wide for a property of the con- ference of the control of the control of the con- trol of the control of the con- secution of the control of the con- secution of the control of the con- secution of the control of the con-	4.	CHERNATE SUM ENGINE MEDITATERS REMAINS TO SAFETY OF THE STATE OF THE SAFETY OF THE SA
REDICTION D	4	one of the country of the continues of the country	•	Received on English controlled by the controlled
BONE VENTALE CONTRACTOR OF THE STATE OF THE	•	NICE CATO OF PARTIES (CONTINUED) RECEIVED TO STRUCKE THE CASE OF A CONTINUE AS THE CASE OF A CO	M	ONE MODEL TO THE STATE OF BOTH SAMED TO SEE THE STATE OF
RETURN RESTORMENT The second discount association is a second		 VERDADY デスト (1887年) 最初的 (1898年) Reds (1998年) では、「1887年) では、「1898年) Reds (1998年) では、「1898年) 	12	SECTION TO ENGINE FOR EVENDAL. SO CLOSE TO SECTION SECTION ASSOCIATION OF SECTION SEC
Text CAPADATE The Capada Capa	•	RESTUMENT OF SPECIAL SAME SAMERSAME REST AND THE SERVICES OF THE SAMERS AS A SAMERS AS A SERVICES OF THE SAMERS AS A SERVICES OF THE SAMERS A	••)	OCHUMALL THE ENGINE REGIL LYERED ROBERT LYER ENGINE THE COMMENT OF
(2) We CANOTE TO SEE THE SECOND SE		CANACHA I (PA ESSENA MEDITAL MEDITA	.:	RECEIVED AN EXPLINATION OF HOME DATA OF THE STATE OF THE
twidstrangewich trafa-		Strategicker with exception for example and in the configuration of the		ONER ALL EXPLOYED AND DESIGNATION OF A STATE
- 明 - 政 - A t Ny ti - Pro Total A total - A		CONTROL OF A STATE OF THE STATE	••• •	REFERENCE ELECTRICAL EN COMPLES CONTROL CONTRO
Mant Can	*	New Edition of Control for each product. We consider the adjustment of the edition of the editi		AND READ OF THE PARTY OF THE PA

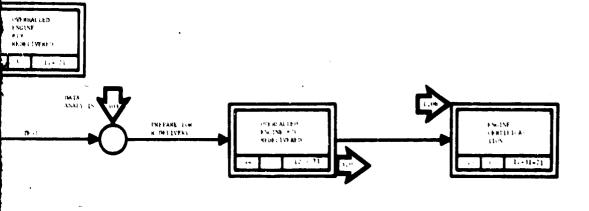
er i de monte











FD 17815

PWA FP 66-100 Volume V

3.07 ENGINE TEST AND EVALUATION-FLIGHT

The operational suitability of the JTF17 engine-airframe combination functioning as a system will be determined, in a large part, by the 100-hour Flight Test Program in Phase III. Pratt & Whitney Aircraft will work with the airframe manufacturer to conduct a flight test program directed at successful demonstration of the capability of the SST to accomplish the basic domestic and international missions.

The prime objective of the flight test program is to demonstrate the operational suitability of the SST engine-airframe combination. The following Phase III program objectives are directed toward this goal.

- 1. Prepare, implement and maintain a flight test program in conjunction with the airframe contractor.
- 2. Demonstrate suitability of the prototype JTF17 engine for flight test by successful completion of the FTS.
- 3. Deliver the twenty ground, taxi, and prototype JTF17 engines.
- 4. Provide adequate engineering and product support coverage at all test sites during all phases of the flight test program.

In order to meet these objectives the following programs will be accomplished:

A program in support of the flight test program will be conducted including distortion testing of the fan and high compressor individual rigs, full-scale engine distortion testing with a distortion generator and a simulated airframe inlet, engine-inlet compatibility testing at AEDC in conjunction with the airframe contractor, airframe component - engine compatibility testing, and the delivery of the twenty ground, taxi, and flight test engines. The ground, taxi, and flight test engines will be instrumented and calibrated since they provide the data for verification of the engine-airframe compatibility and suitability.

The ground test program is a coordinated effort with the airframe contractor and will include uninstalled ground tests and installed ground tests to determine noise characteristics, starting characteristics, forward and reverse thrust response, performance, vibratory characteristics, inlet distortion, foreign object ingestion susceptability, and maintenance demonstrations.

The flight test program is a coordinated effort with the airframe contractor and will include performance, windmill test, vibratory characteristics, inlet distortion, main and duct heater relights and fuel control system tests at steady state and transient conditions.

Pratt & Whitney Aircraft will provide qualified engineering field service and technical personnel at all field activities in ample time to ensure coordination with the airframe contractor and completion of plans and facilities prior to ground and flight test operations. Pratt & Whitney Aircraft will provide field service representatives, field engineers, spare parts representatives, technicians, ground support equipment and spare parts required for maintenance and operation of the JTF17 engine throughout the flight test program.

PWA FP 66-100 Volume V

The major milestones, network chart and event dictionary for the engine flight test program are shown in figures 11 and 12, respectively.

A detailed description of the flight test program is presented in the Test and Certification Plan, Volume III, Report E, and test planning and integration is presented in Test, Volume IV, Report E.

Pratt & Whitney Aircraft PWA FP 66-100 Volume V

FD 17894 VH

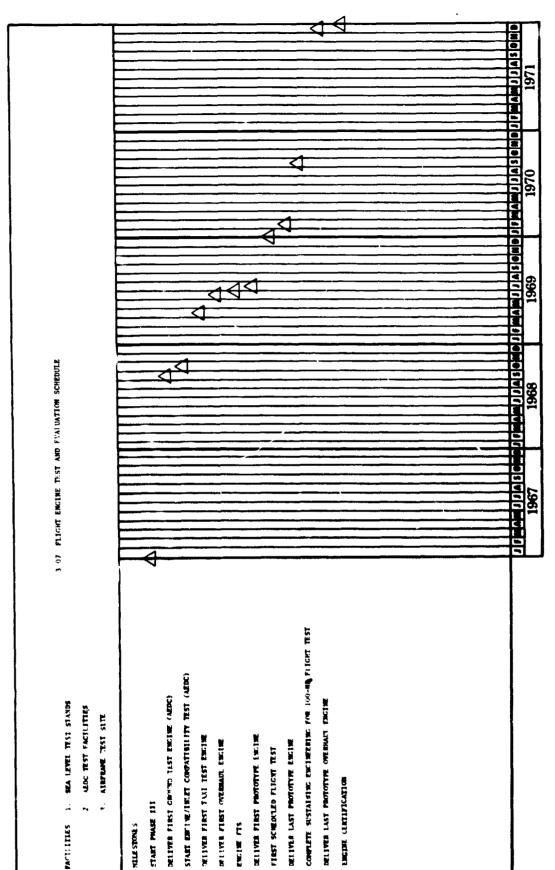
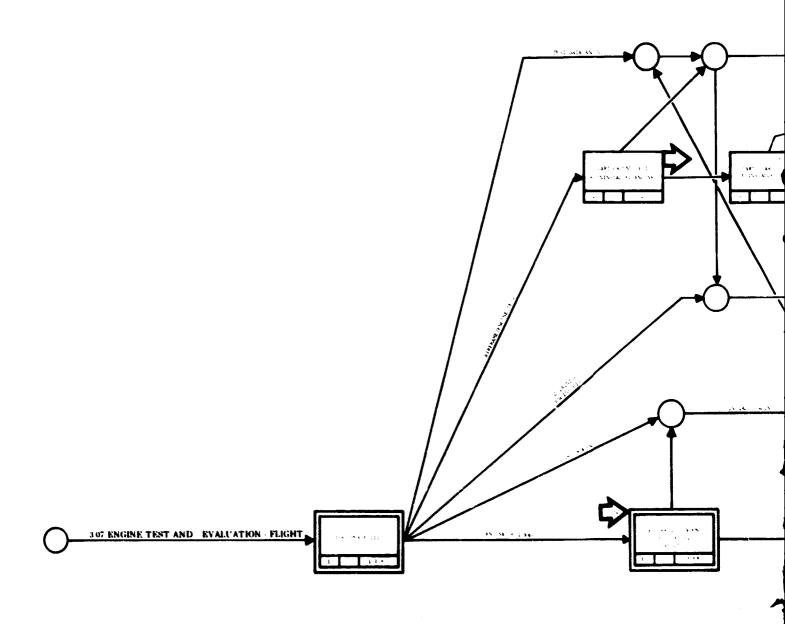
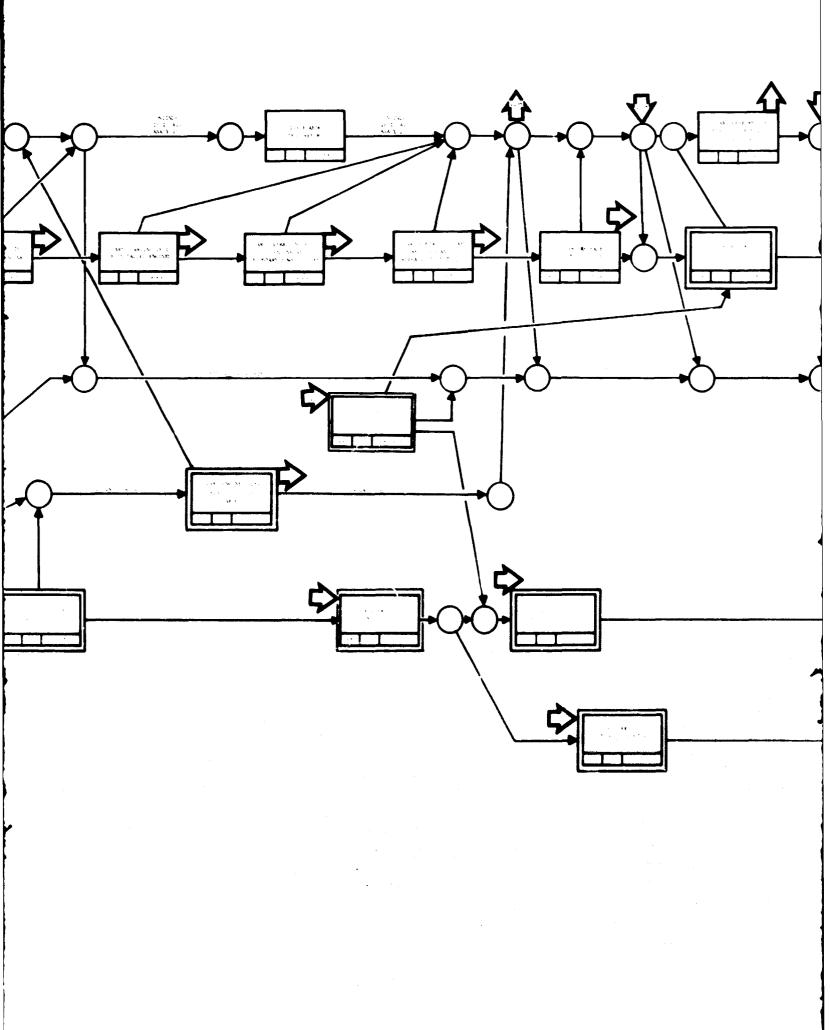
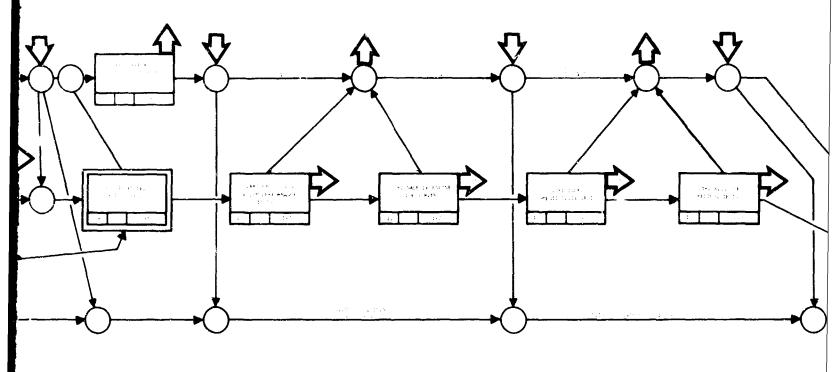


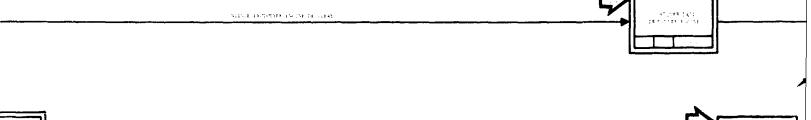
Figure 11. 3.07 Engine Test and Evaluation - Flight





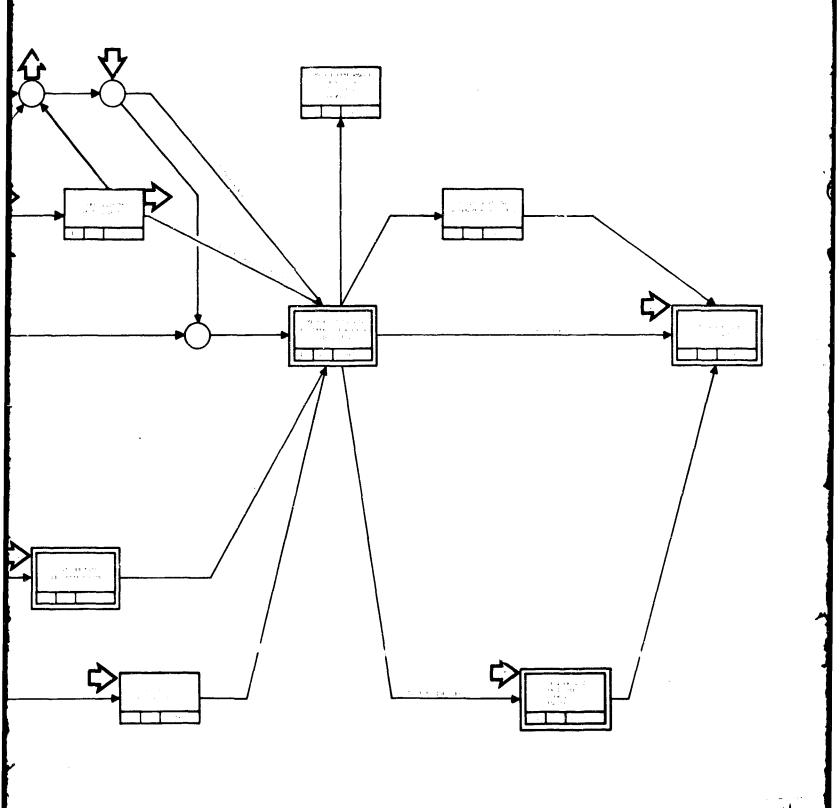
gine Test and Eveloption-Flight





April 1995 April 1995

	es a file situ					
		F., + 8, 44+	feminate over thatetee	1 x 1 X 12 x	April 1	
, , , , , , , , , , , , , , , , , , , ,	Make the State of Make the State of Sta		 Construction (A) (A) (A) (A) (A) (A) (A) (A) (A) (A)		and the second	
					•	
to the contract of			 A transfer of the second of the		and the second second	
• • • • • • • • • • • • • • • • • • •			METALLINE STATE OF ST		•	
	Section (Section)		 Problem 19 (1998) 1993 (1998) 11 (1998) 1994 (1998) Problem 1994 (1998) 11 (1998) 1995 (1998) 1996 Problem 1996 (1998) 1996 (1998) 1996 Problem 1996 (1998) 1996 			
······································	e transfer		 Orași de la construit de la const			
		•	#BANK COLOR DESCRIPTION FOR SECURITY OF SE			
			(b) The confidence of the c		in the second second section is a second sec	



3.08 DATA AND HANDBOOKS

All publications required for the operation, maintenance, overhaul and logistics support of the JTF17 engine will be published and distributed by the Service Publications Group as described in detail in Product Support, Volume IV, Report F, Section VI. Revisions to reflect changes in procedures or configuration will be issued as necessary throughout the service life of the engine.

Engine operation and maintenance data requirements by the airframe manufacturer for inclusion in the aircraft maintenance and flight operations manuals will be provided by Pratt & Whitney Aircraft in scope and scheduled to assist the airframe manufacturer in meeting the program requirements. Pratt & Whitney Aircraft will also review and provide technical comments on engine data prepared for distribution in the airframe manufacturer's manuals

The following criteria are used in the preparation and publication of data and handbooks for the JTF17 engine:

1. Format - Engine Maintenance and Overhaul Manuals, Illustrated Parts Catalogs, and Service Bulletins will be in strict compliance with ATA Specification No. 100.

Installation Handbooks, Operating Instructions, Special Tool Manuals and Facility Planning Manuals, which are not required by ATA Specification No. 100, will be presented in a standard P&WA format that has been used successfully in past and current commercial airline engine programs.

- 2. Accuracy The JTF17 publications will be prepared by a team of experienced technical writers. Each publication will be reviewed by Product Support technical specialists and by appropriate Project Engineering personnel. All basic publications and revisions will be validated prior to issuance.
- 3. Comprehension and Completeness All data and handbooks will be written in a clear, precise manner with short, direct sentences and paragraphs. The scope and purpose of each publication will be stated in the introduction; detailed indexes as well as tables of contents will be included. Illustrations, charts, graphs, and tables will be employed to minimize the need for complex textual explanations, and abbreviations or complex technical terms will be fully explained. Cautions and warnings will be included in accordance with ATA Specification No. 100 requirements to eliminate the possibility of hazard to personnel or equipment.

The basic publications will contain all available data required for support of the JTF17 engine.

PWA FP 66-100 Volume V

4. Schedules - Pratt & Whitney Aircraft will provide the following publications to support the JTF17 engine and scheduled to be consistent with engine deliveries and other milestones to ensure timely availability:

Installation Handbook Available 1966 Operating Instructions July 1968 Service/Overhaul Manual September 1968 Engine Maintenance Manual April 1969 Illustrated Parts Catalog July 1969 Service Bulletins As required General - Airframe Data As required Facility Planning Manual Phase IV Engine Overhaul Manual Phase IV Accessory Component Overhaul Manual Phase IV Engine Special Tool Manual Phase IV

All publications will be updated every 90 days, or more frequently if required, to reflect changes in engine configuration, operation, test, maintenance, etc.

PWA FP 66-100 Volume V

3.09 TRAINING AND TRAINING EQUIPMENT

TRAINING

The Pratt & Whitney Aircraft Service School has been conducting customer training courses with a professional instructor staff since its founding in 1935. Turbojet engine training for approximately 18,000 engineers and technicians has been provided by the staff now numbering 25. A portion of this training has covered supersonic engines, including extensive courses on the J58 engine.

The necessity for proper and timely training of customer personnel to ensure the level of knowledge and capability necessary for engine operation, maintenance and logistic support is fully recognized, and courses covering all support phases of the JTF17 engine will be presented. This training plan is described in detail in Product Support, Volume IV, Report F, Section VI.

The various types and content of training programs and staiting dates are based upon our past experience, knowledge and evaluation of the JTF17 and the schedules for SST ground, flight test and airline operation.

All courses will be updated as required to reflect changes in engine configuration and operation and will be repeated as necessary to satisfy customer requirements throughout the service life of the engine.

The courses and starting dates of instruction to be presented to the FAA, airlines, and airframe personnel are as follows:

Staff Orientation	May 1967
Operation and Performance	July 1967
Operation and Test	June 1968
Organizational Maintenance	July 1968
Expanded Operation and Performance	Phase IV
Heavy Maintenance	Phase IV
Overhaul	Phase IV
Engine Flight Simulator Training	To be coordinat

Instructors experienced in the preparation and presentation of training courses for airline operators will be selected for the JTF17 program.

The instructor staff will be assisted in the technical preparation by personnel from the Design, Project Engineering, and Product Support organizations to ensure accuracy and completeness of all phases of JTF17 support training.

TRAINING EQUIPMENT

The Pratt & Whitney Aircraft Service School will employ modern training equipment and training aids for the JTF17 engine program, described in detail in Product Support, Volume IV, Report F, Section VI, as dictated by the requirements of the different courses.

PWA FP 66-100 Volume V

The following is a brief description of the equipment which will be used:

Training Texts
Schematic Diagrams
VuGraph Transparencies
Movies and/or Vidco Tapes
Engine Parts and Cutaways
Operable JTF17 Engine
Engine Test Stand
Engine Tools and Fixtures
Miscellaneous Student Equipment

PWA FP 66-100 Volume V

3.10 GROUND SUPPORT EQUIPMENT

Specialized equipment required for the maintenance, overhaul and test of the JTF17 engine will be designed, verified and released for manufacture by the Service Tools and Equipment Group, described in detail in Product Support, Volume IV, Report F, Section VI.

Experienced personner from the Tools and Equipment Group, Design, Project, Maintainability and Service Engineering have conducted an extensive study of the JTF17 engine and of current airline practices in establishing the GSE concept which will be utilized in SST operation.

The modular design and other maintainability features of the JTF17 engine described in the Maintainability Program, Volume IV, Report F, Section I, will permit extensive maintenance of the engine while installed in the airplane. Close engine/airframe coordination will be maintained with the manufacturer to ensure that adequate engine tooling will be designed for all possible installed maintenance and inspection tasks.

GSE and facilities utilized for other P&WA engine models will be reviewed in order to avoid duplication and, where possible, modified to permit common usage.

GSE designers and process planners, in conjunction with representatives of Engine Design, Service Engineering, Maintainability, Human Engineering, and other appropriate elements will design all special engine equipment required for field support of the JTF17 engine.

Tooling provided for the ground and flight test programs will be of the same quality and design standards as employed for airline operation. Prior to release for service use, each new or modified tool will be validated by use on an engine. Personnel from the Tools and Equipment and other affected groups will witness the maintenance tasks which will be performed by technicians with normal skill levels.

Upon completion of validation, the P&WA equipment is placed under an Engineering Change system in the same manner as engine parts. Each Engineering Change in process against the engine is reviewed by the Tools and Equipment. Group to determine whether tooling is affected. If existing equipment. The ideal or modified, redesign is initiated and released by a Service Tool Engineering Change.

Applicable ground support equipment will be delivered to the required locations three months prior to receipt of the first engine at each location.

Pratt & Whitney Aircraft PWA FP 66-100 Volume V

SECTION IV CROSS-REFERENCE INDEX

DETAIL WO	RK PLAN	WORK STATEMENT ITEM	PHASE III RFP
Section	Page		Section
1.01	VH-5	Engine Design	2.01
1.02	VH-9	Fabrication and Assembly	3.02 2.01
1.03	VH-15	Tooling	2.02 2.01
1.04	VH-19	Engine Instrumentation	2.03
1.05	V H-23	Test Equipment	2.04
1.06	VH-27	Engine Test - Ground	2.05
1.07	VH-37	Engine Performance	3.01
1.08	V H-41	Inlet System Compatibility	1.10
1.09	VH-45	Noise	1.11
1.10	V H-49	Growth Potential	3.03
1.11	VH-53	Fan and Compressor	1.01
1.12	VH-57	Primary Combustor	1.02
1.13	VH-61	Turbine	1.03
1.14	V H-65	Augmentor	1.04
1.15	VH-69	Exhaust System	1.05
1.16	VH-73	Contrain and Accessories	1.06
1.17	VH-79	Lubricants, Lubrication System, Bearings, Seals and Gears	1.07 1.09
1.18	VH-85	Fuels	1.08
1.19	VH-89	Manufacturing Techniques and Materials	3.04
1.20	VH-93	Weight Control and Status	3.05
2.01	VH-97	Coordination	1.13
2.02	VH-99	Maintainability and Human Engineering	4.01 4.07

Pratt & Whitney Aircraft
PWA FP 66-100
Volume V

CROSS-REFERENCE INDEX (Continued)

DETAIL WO	RK PLAN	WORK STATEMENT ITEM	PHASE III RFP
Section	Page		Section
2.03	VH-103	Reliability	4.02
2.04	V H-107	Quality Assurance	4.03
2.05	VH-111	Value Engineering	4.04
2.06	VH-115	Configuration Management	4.05
2.07	VH-119	Safety	4.06
2.08	VH-123	Test Planning and Integration	4.08
2.09	VH-127	Data Management	6.01
2.10	VH-131	Program Management and Controls	6.02
2.11	VII-133	Facilities Plan	6.03
2.12	VH-137	Cost Analyses	6.04
2.13	VH-139	Proposals	6.0
3.01	VH-141	Ground, Taxi and Flight Test Engines	2.06
3.02	VH-145	Tooling	2.08 2.01
3.03	VH-149	Engine Performance	3.01
3.04	VH-153	Engine Mockup	1.12
3.05	VH-157	Spares	5.03
3.06	VH-159	Overhaul	5.0
3.07	VH-163	Engine Test and Evaluation - Flight	2.06 2.07
3.08	VII-167	Data and Handbooks	2.08 5.01
3.09	VII-169	Training and Training Equipment	5.02
3.10	VH-171	Ground Support Equipment	5.04